



# UNESCO/IGU Workshop on Women in Engineering in Africa and the Arab States

*UNESCO, Paris, 10 December 2013*

*Summary record*

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**UNESCO/IGU Workshop on Women in Engineering  
Paris, 10 December 2013**

**Agenda**

**Opening**

9:45 – 10:30

Homage to Nelson Mandela by Gretchen Kalonji, Assistant Director-General of Natural Sciences, Master of Ceremonies

Address by Irina Bokova, Director-General of UNESCO

Address by Jérôme Ferrier, President of the International Gas Union

Video message by Dr. Kandeh Yumkella, UN Secretary-General's Special Representative on Sustainable Energy for All and IGU Wise Person

**Roundtable on Women in Engineering in Africa: Enticing Young Women into STEM**

**Education**

10:30 – 12:30

Moderator: Dr. Lidia Brito, Director of Division of Science Policy and Capacity Building, UNESCO

Panelists: Ms. Maha Ayoub, Deputy Ambassador of Sudan to UNESCO, Sudan

Ms. Anne Wangari Kirima-Muchoki, Chairperson, Kenya Investment Authority

Dr. Tonya Blowers, Programme Coordinator, Organization for Women in Science in the Developing World

Ms. Gretchen Kalonji, Assistant Director-General of Natural Sciences, UNESCO

**Break**

12:30 - 14:30 Lunch

**Roundtable on Women in Engineering in the Arab States: Identifying Best Practices for Attracting Women to Careers in Engineering**

14:30 - 16:30

Moderator: Eng. Khaled Abu Bakr, Executive Chairman of TAQA Arabia, Egypt, and Regional Coordinator Middle East and Africa, International Gas Union

Panelists: Honorable Dr. Laila Rashed Iskandar, Minister of State for Environmental Affairs, Egypt

Dr. Amina Benkhadra, General Director, National Office of Hydrocarbons and Mines, Morocco

Dr. Fareeha Zafar, Government College University, Pakistan

Eng. Fadwa Abu Ghaida, President, Arab Women Engineers Committee, Federation of Arab Engineers

**Conclusion**

16:30 - 16:45 Address by Ms. Saniye Gülser Corat, Director, Division for Gender Equality, UNESCO

**Opening**

**Getachew Engida, Deputy Director General of UNESCO**

Excellency Dr Laila Rashed Iskandar, Minister of State for Environmental Affairs of Egypt,  
Honorable Ms Maha Ayoub, Deputy Ambassador of Sudan to UNESCO,  
Mr Jerome Ferrier, President of the International Gas Union,  
Excellencies, Ladies and Gentlemen,

**On behalf of the Director-General, Ms Irina Bokova**, I am pleased to welcome you at UNESCO for this workshop on *Women in Engineering in Africa and Arab States*, organized with the International Gas Union.

I wish to thank Dr Kandeh Yumkella, Special Representative for the United Nations Secretary-General on Sustainable Energy for All and also IGU Wise Person, for his video address.

The theme of women in science is one to which UNESCO is deeply committed.

Science and engineering hold important answers to key questions we must address today – about equitable and inclusive growth, about climate change, about sustainable energy for all, about international cooperation for peace and sustainable development.

They also hold answers for promoting gender equality, for making the most of the creativity of *every* member of society.

For the moment, this is not the case, and challenges remain steep.

Engineering reflects the difficulties experienced across the sciences with regard to gender equality, remaining a male-dominated discipline.

The situation is slowly changing.

If we compare class photos of graduates in engineering from a few decades ago with more recent photos, we can see the change that is underway -- the number of women studying engineering is increasing across the world.

The picture varies greatly according to region.

In Europe and the United States, women represent 30 percent of engineering students at university, while this figure reaches 15 percent in South Africa and even 60 percent in some countries of the Arab region.

These are positive trends we must accelerate – but they are not enough, because we also need to ensure a smooth and rapid transition for women from the world of education to the world of work, where there remains still a deep gap.

No country today can afford to leave aside 50 percent of its creative genius, 50 percent of its innovation, 50 percent of its economic drivers.

This is why gender equality in engineering is so important.

We need to attract *every* young mind to engineering, especially in the developing world, and we need to help them transition into the employment market.

Only then can we eliminate persistent stereotypes about gender roles – only then can we make class photos that feature *only men* a thing of the past.

Science, technology and innovation is essential for the creation of sustainable, knowledge societies -- but many countries are still unable to make the most of their potential.

This is why this discussion on Africa and the Arab regions is so important – to strengthen the link between the sciences and engineering and national development strategies.

If we look across the African continent, we can see evidence of growth and development – Africa is rising, indeed.

But to sustain this rise requires investment in the skills and talents of Africa's young people, especially in girls and young women.

For instance, an estimated 2.5 million new engineers and technicians are required in sub-Saharan Africa to achieve the Millennium Development Goals of improved access to clean water and sanitation.

In Namibia, Zimbabwe and Tanzania, there is one qualified engineer for a population of 6,000 people -- compared to one engineer per 200 people in China.

Through its *Engineering Initiative*, UNESCO is working with Africa countries to put science, technology, engineering and mathematics (STEM) education at the heart of national development strategies.

For instance, we organized with the *International Centre for Theoretical Physics*, a Science and Engineering Week at the University of Nigeria, Nsukka, which reached 1600 students.

In the framework of our *Global Partnership for Girls' and Women's Education* launched in 2011, UNESCO has developed partnerships the leading private sector companies.

Last April, we signed with INTEL an agreement to promote STEM in Africa, by building capacities and developing learning materials.

In Kenya and Lesotho, our partnership with GEMS Education supports girls' and women's access and advancement in the learning and teaching of sciences, mathematics, engineering and technology.

Mesdames et Messieurs, dans la région arabe, le plus grand défi pour les femmes ingénieures est d'entrer sur le marché du travail.

Une fois leur diplôme en poche, beaucoup d'étudiantes sont bloquées dans leurs carrières, en raison des barrières culturelles ou religieuses.

Le manque de politiques familiales et l'équilibre difficile entre la vie privé et la vie professionnelle empêchent de nombreuses femmes de s'épanouir dans leur carrière.

C'est un immense gâchis pour elles et pour toute la société qui se prive d'un atout pour construire une société du savoir durable.

Il est possible de renforcer le lien entre l'éducation et l'emploi.

Il est possible de donner aux jeunes filles la confiance et l'envie d'être ingénieures en montrant des modèles positifs de réussite – en montrant que l'on peut être ingénieur au féminin.

Des initiatives comme le prix et les bourses du *Programme UNESCO-L'Oréal pour les femmes et la science* démontrent qu'il est possible de briser les stéréotypes.

L'une des lauréates de ce prix, Dr. Tebello Byokong, d'Afrique du Sud, a justement déclaré :  
*It was very difficult for me to progress, so I vowed I will help other women as much as I can. Their confidence levels are not as high. I don't know why, but men are confident even when what they are saying does not make much sense!*  
I am sure there are many other examples like this to share.

Let me thank you all once again for coming. I wish you fruitful discussions and look forward to your conclusions.

Thank you very much

**Jérôme Ferrier, President of the International Gas Union**

Mr Deputy Director-General of UNESCO,  
Excellencies, Ladies and Gentlemen

Professor Muhammad Yunus, the 2006 Nobel Laureate for Peace, once declared: *“I strongly believe that we can create a poverty-free world, if we want to.... In that kind of world, the only place you can see poverty is in the museum. When school children will be on a tour of the poverty museum, they will blame their forefathers for tolerating this inhuman condition to continue in a massive way.”*

Instead of waiting for that day to occur, we should make it happen as soon as possible, using the available natural resources and calling on all human talents to the service of a sustainable global development.

Obviously, this requires that no talent pool is left untapped and assigns an outstanding importance to achieving the third Millennium Development Goal, which is to *“Promote gender equality and empower women “*.

In an inspiring report issued by UNESCO in 2010, entitled *“Engineering: Issues, Challenges and Opportunities for Development”*, featuring contributions from 120 experts around the world, it was shown that engineering is vital for raising standards of living and creating opportunities for sustainable prosperity. The report reveals that developed countries typically have 20 to 50 engineers per 10 000 of the population, while they are often less than one in most African countries.

The poorest are hit hardest by the lack of engineers, with 1.1 billion people having no access to clean water, 2 billion with no electricity supply and nearly one billion going hungry on a daily basis. The report underlines that around 2.5 million new engineers are needed only in Sub-Saharan Africa, just to ensure provision of clean water and access to energy for everyone. The report calls for increasing public and policy awareness of engineering as a key driver of innovation, as well as social and economic development.

On this ground, it is obvious that the world can no longer afford the significant gender gap in engineering that currently exists, that engineering should not be regarded as a man’s world, while women are often the ones to experience problems that can be solved by engineering.

Three years after the publication of UNESCO’s report, it is no longer time to raise the question *“Why aren’t there more Women Engineers?”* but to gather, for collective benefit, feedback on the result of actions developed to increase the global ranks of women engineers and to share all the positive experiences and efforts made to foster access for women and young people to engineering careers, as well as pitfalls encountered.

I do hope that the two Round Tables that will follow will take us one step further in this direction.

Excellencies, Ladies and Gentlemen,

The energy industry creates jobs and offers a wide range of possibilities for upgrading the human potential in developing countries. It is at the heart of the population’s needs for access to electricity, desalination and treatment of water, as well as for the supply of clean fuels for domestic purpose as opposed to coal and wood, when deforestation is at stake.

With more than 250 years of reserves and a more even geographical distribution of resources than for oil, natural gas is a key asset on the path to sustainable energy access for all. It is a great opportunity for humankind but also a challenge for the gas industry to ensure that the development of this resource, from the well to the final consumer, triggers local education and training in the countries of operation. It is also essential that the oil and gas industry endeavours draw more widely on the pool of female talent.

This is why the International Gas Union has enthusiastically responded to the invitation of UNESCO to join in the organization of this Workshop. IGU is an independent and non for profit global organization with 83 member countries representing over 95% of the global gas market. Among IGU's members, there are 10 African countries and 8 from the Middle East.

The working organisation of IGU covers the complete natural gas chain, from exploration and production, pipeline gas transmission and LNG international trade, as well as the development of new technologies for the most efficient use of natural gas.

One of the major goals of the 2012-2015 IGU's triennium is to encourage the gas industry to create and develop bridges with academic institutions in its member countries on a wide range of issues of common interest.

Concrete programmes of action have been launched, for identifying medium- and long-term human resource needs in the gas and power sectors, carrying educational activities at college level and sharing R&D programmes with universities.

IGU's experience shows that the contribution of the oil and gas industry in competency building, capacity enhancement and promotion of women's careers can be significant and that it forms part of a unified managerial approach of human resources. A priority should be assigned to nurturing the development of local talent pools towards engineering careers, among the generation of scholars and students, and also to creating conditions enabling the recruitment and retention of women for a long run career.

The first priority is developing local talent pools, since generally, experienced engineers are in short supply. To achieve this goal, industry and governments must collaborate to ramp up the education system to fulfil industry needs, with a view to ensuring an alignment of interests between industry and country and maximize the benefit derived from the resources allocated to schools and universities. It should be kept in mind that, in the oil and gas industry, indirect and induced jobs may represent up to 10 times direct jobs. As an illustration, in Angola, 2 000 jobs have been indirectly created in the banking sector; mainly from the growth in the petroleum sector.

The second priority is implementing corporate policies for retaining women in the engineering workforce. In this field, there is no "*One size fits all*" solution and specific packages must be tailored according to the social, cultural and regional frameworks. Such packages should address the following key items for successful employment of women: mentoring and networking of female engineers, pregnancy status, parental leave and childcare support, dual career considerations, equal career opportunity with men, flexible promotion planning, and part-time alternatives.

However, women often fail to meet their full professional potential as a result of three main obstacles:

- Lack of attention and supporting policies, forcing women to stagnate or leave after some time;
- Marginalization, diverting women from the leadership track into less rewarding careers;
- Cultural self-restrictions from women themselves that may impact the choice for a career in engineering.

IGU is addressing these priorities through a Task Force dedicated to Human Resources with a special focus on the attractiveness of our industry for young people and the promotion of women in engineering careers.

The task force provides useful feedback to its members on the different regional paths to curtailing the three above-mentioned shortcomings.

IGU, through its global network of oil and gas companies, helps its members to better leverage the reservoir of female talents by implementing a series of adequate solutions, notably by exposing women early on to operations and training, ensuring career development and management, and involving senior women in designing creative solutions and coaching.

I would say that empowering women for leadership in engineering requires a joint effort from society, governments, companies, families and women themselves. Success is like a candle's flame, the result of a magic alliance between the wax, the wick, the air and the match...

To conclude, I would like to join the Deputy Director-General of UNESCO in expressing my gratitude to all the panellists who agreed to participate in this Workshop to share their experiences with us. This gives me the opportunity to confirm IGU's support and commitment to furthering the cause of Women in Engineering.

Thank you for your attention.

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Before leaving the floor to the panellists of our first round table, I would like to share with you the regrets of Dr Kandeh Yumkella, the UN Secretary-General's Special Representative on Sustainable Energy for All and IGU Wise Person, who was unable to join us today but was keen to greet you in the video message that you will see now.

[https://dl.dropboxusercontent.com/u/6602231/Forum%20IGU%20-%20UNESCO%20-%20Women%20in%20Engineering%20PARIS\\_title.mov.zip](https://dl.dropboxusercontent.com/u/6602231/Forum%20IGU%20-%20UNESCO%20-%20Women%20in%20Engineering%20PARIS_title.mov.zip)

## **Roundtable on Women in Engineering in Africa: Enticing Young Women into STEM Education**



Moderator: Dr Lidia Britto

*Director, Division of Science Policy and Capacity Building, UNESCO*

Dr Kandeh Yumkella made a very important statement: More women engineers! That is what is important and that is what our first Roundtable will be concerned with. If we do not empower women and attract them to science and engineering professions, many issues and challenges that they face – and that have an impact on all our societies – will not be addressed. In that context, today's meeting is extremely important, as is UNESCO's Engineering Initiative, which has Africa as a focus region.

We are honoured to have such a distinguished panel with us today: • Ms Maya Ayoub, Deputy Ambassador of Sudan to UNESCO • Ms Anne Wangari Kirima-Muchoki, Chairperson of the Kenya Investment Authority • Dr Tonya Blowers, Programme Coordinator for OWSD • Ms Gretchen Kalonji, Assistant Director-General of Natural Sciences, UNESCO.

The panellists will each address the topic of the Roundtable and we will then open the floor to your questions and comments.

**Ms Maha Ayoub, Deputy Ambassador of Sudan to UNESCO, Sudan**

In Sudan, women represent 55% of all undergraduates. Yet only 20% of those students choose to study engineering and only 5% end up joining the engineering workforce. When I first heard these figures I wondered if Sudan was not an exception in the world. However, in the UK, only 6% of the engineering workforce is female, and that figure is quite similar for all industrialised countries. A flagrant gender gap in engineering does indeed exist, and not only in Sudan.

This monumental disparity between men and women in the engineering field has been explained as follows. In developing countries traditional gender role thinking is still predominant, acting as a barrier to women entering the engineering field. Women are excelling in medicine, law, pharmaceuticals and teaching. Why do they not choose to study engineering? My own mother was a brilliant student, and was ranked first in Sudan and Egypt. She wanted to become an engineer but her father – who was otherwise a proponent of education for women – did not believe that engineering was an appropriate discipline for women.

Engineering associations attribute the paucity of women in the field as the result of, first, a failure to explain how engineering can help people's lives. Second, there is a lack of awareness among girls as to what engineers actually do. Third, women feel uncomfortable about entering a male dominated world. Fourth, women have a basic desire to fit in. These are seen as the main reasons why the engineering field is male dominated everywhere in the world. In addition, there are certain biases in the academic world that impede women's progress in this area.

What is the road ahead? It is clear that the absence of half of the population from engineering is not sustainable. The role of early education has been identified as one of the main barriers to women's entry into scientific fields. Guidance on course selection in high school is another,

as is the extent to which families and schools recognise science as an appropriate field for women.

What about the work environment, working hours and conditions governing these professions? How well do they accommodate the lives of women? What maternity leave is available? How is child care organised? It is clear that a radical reform of the entire system is necessary if we are to enable women to reconcile their family lives with their careers.

In Sudan, the main challenge in rural areas remains access to and completion of basic education. Illiteracy rates remain high at 34%, and are even higher for women in rural areas. The real challenge is to ensure that these girls in particular can have a career and become economically independent while also taking care of their families, if that is what they wish.

**Ms Anne Wangari Kirima-Muchoki, Chairperson, Kenya Investment Authority**

I am a chartered surveyor by training, married with 3 children. I will start my presentation with a personal story. I was born into a polygamous family. My father had 3 wives and 14 children. My mother had 6 girls and 1 boy. I am the 6<sup>th</sup> of 7 children. My father had very little education. My mother had less. However, during the time of Kenya's independence, my father took an educational trip to England where he stayed with the Slater family. That meeting in a developed country educated my parents and showed them the importance of education. They went on to educate all of their children in England. That one meeting is the reason I went on to have 3 degrees – simply because the Slaters convinced my father that we could do more than get married and have children; that we could make a contribution to our country.

40 years later, all the girls in the family are doing very well, although the boys should be doing better. I try very hard to balance my work, career and responsibilities as a mother, and believe that there are many things we have to do to improve the situation for female children. The challenges faced by girls include attitudes to education, quality of education received in science subjects, and social influences such as parents or role models. In 2002, Kenya extended free primary and secondary education to all children. However, even when girls go to school, they are still expected to do all the household chores when they go home, in contrast to their brothers.

In the professions, gender stereotypes mean inequality in terms of salaries and promotion opportunities. We also have to deal with gender blind workplace policies, and the tendency to cast women in supportive roles. However, I always tell women that they can make a difference. If they see these things that should be changed, they should not be afraid to raise them. I have always believed that we can all make a difference no matter where we are. If we all did that, we could change the world.

Affirmative action is now in practice in Kenya. Our new constitution requires at least one-third of each gender at every level of government, and for the first time ever we have 6 female ministers out of 20. Even more importantly, they have been given important ministries such as Defence and Foreign Affairs. That has conveyed a very important message to young women in our country.

Role models are also very important. As our government is changing and bringing women forward, girls are seeing that they have alternatives. There has also been a great increase of women in IT, which has had a positive impact.

In conclusion, it is clear that it is not women's insufficiencies that prevent them from entering the engineering field; it is the social and institutional barriers that they face.

**Dr Tonya Blowers, Programme Coordinator, Organization for Women in Science in the Developing World**

I will focus on a number of practical actions that my organisation has been taking for 25 years in order to improve the number of women in STEM education in developing countries. Our role is to inform policy makers about how science can change people's lives on the ground. If women's needs and first-hand experience of many issues can be taken on board, that can really make a difference – especially as we know that women are responsible for growing, processing and cooking food. If we can build up a critical mass of women with doctorates in developing countries we can have a knock-on effect that is extremely positive. A woman with a PhD in a STEM subject in a developing country will be asked to participate in government, science academies, committees, and so on. That is the knock-up effect of having a PhD. The knock-down effect is that you have the opportunity to train other women in the new concepts, methodologies and research that are emerging. OWSD is therefore putting all its money and energy into building up the number of women PhDs in developing countries around the world, including Asia.

OWSD has over 4,000 members in the South, all women who could potentially be connected to each other. We have an online information service that is used by 3,000 active members. We have 2 main programmes today: (a) the PhD fellowship programme and (b) our prize scheme: the Elsevier OWSD TWAS award, which was launched in 2010 in Beijing. The incredible importance of role models for women in science means that the UNESCO L'Oreal prize for Women in Science is extremely important. Networking and support mechanisms are also crucial – we have to ensure that women make the kinds of connections that men make quite easily, and that includes meeting other people who are movers and shakers in international conferences and seminars.

The OWSD Fellowship Scheme invites applications from women only, in the least developed countries and Sub-Saharan Africa. Fellowships can be applied for at PhD or MSc level in any science subjects. The maximum age is 40 but exceptions to that rule are possible. It is a South-South fellowship, with host countries also based in developing countries around the world. As this is less expensive, it means that we can provide funding to many more women. At the same time, we have done a lot of research on centres of excellence and we know where we can send women to ensure they get an extremely good education. By remaining within the South, the women are also more likely to complete their studies.

Applicants have to be exceptional and capable of undertaking a PhD. The selection process is based on merit. We award up to 50 PhDs grants per year, that include a stipend, travel and medical insurance, and \$5,000 per year per grantee for conference travel. That travel is very relevant for these students. The host institute covers the study fees and research costs. South Africa is the biggest recipient of our students.

To date, 129 women have graduated, and SIDA has invested \$6 million in the programme since 1998, increasing its funding by \$1.4 million per year. We have 91 students on site at the moment. The majority are in agricultural sciences, and we have only one engineering PhD candidate at the moment. I would encourage you all to send us your most gifted engineering students.

Going forward, we hope to fund more PhDs, more leadership training, and more prizes. We would also like to improve access to data in this area, which is sorely lacking today.

**Ms Gretchen Kalonji, Assistant Director-General of Natural Sciences, UNESCO**

I will offer some personal perspectives on this topic and then provide an overview of the UNESCO Engineering Initiative that was launched 2 years ago.

The challenges faced by women in engineering are similar in both the developed and developing world. The key challenge is the need for a radical transformation of our education systems, in particular higher education. A crucial factor leading to the paucity of women in science and engineering has been the failure to show the relevance of engineering to society. What engineers actually do on a day-to-day basis is very far from people's perceptions of what they do. Engineering is in fact a fundamental mechanism for solving the major challenges faced by society. Women have a real desire to enter professions where they can help people but they do not, unfortunately, see engineering as such a profession.

Real engineers work in teams on the basis of collegial relationships. The problems we address are intrinsically multidisciplinary. They are also closely linked to society. The way that engineering is currently taught, however, completely misses that aspect. Typically it is only in senior years that students have the opportunity to apply their knowledge to real problems, and the early emphasis on theory is one of the reasons for the high attrition rates among students, especially female students. We therefore need to transform the practice of engineering education. The most successful initiative to get women into these professions has been to bring multidisciplinary and practical problems to the first years of study, and that has proved to be successful in many countries.

When it comes to secondary and primary education, we all know that children are born engineers and love to build things. However, at school, science education is all about learning facts and unveiling the world and the laws of nature. In contrast, engineering is about building a new world. In all aspects of the educational system it is important to have partnerships with the different levels of society. We also know the importance of an entrepreneurial focus, which helps to attract and retain students.

The UNESCO Engineering Initiative was launched in November 2011 on the basis of a resolution from the South African delegation. The initiative spans a number of existing platforms that are already working to enhance the place of women in engineering. Incorporating gender related aspects into all our policy domains is also important. The need for more data at the worldwide level has been recognised, in particular to allow us to make international comparisons and track trends. We are actively working on the transformation of pedagogy with our partners – professional engineering societies, industrial partners, university associations, and science and engineering academies. Student societies are a final important partner, whose energy and creativity we can harness.

In conclusion, the UNESCO Engineering Initiative has a multi-dimensional focus on pedagogy, policy, data, and on building up on the community of young people worldwide.

**Dr Lidia Brito**

*[Video presentations.]*

I will now open the floor to questions and comments from the audience.

### **Laurie Chawick, American Gas Association**

All the issues that have been raised are very relevant to understanding why there are not more women in engineering today. Another challenge, however, is that engineers are not very good at communicating about themselves or their profession. They tend to be very technical when talking about their jobs and are not able to convey just how exciting this field can be. How can this issue of communications be addressed?

### **Ambassador of Libya to UNESCO**

In Libya, and probably elsewhere in the world, we have found the women tend to go into the life sciences. They tend to prefer biology, for example, over physics and maths. How do you explain that phenomenon?

### **Public Office for Research in Gas and Mining, Morocco**

What are the practical means for raising awareness of the need to get women into engineering? We all know that this is a universal problem, in developing *and* developed countries. The problem has to do with stereotypes in education. We therefore have to help all countries to change their curricula from a very early age. What can UNESCO and other international organisations bring in terms of practical hands on solutions in this area?

### **Rafi Kubar, Resource Centre, Tunisia**

An important factor here is the need for women to be present when and where decisions are made. Second, the work-life balance is the biggest issue faced by women. In Tunisia, the choice of university paths for women is driven by (a) employment opportunities, and (b) the work-life balance. Women favour teaching jobs as they enable them to spend more time with their families.

### **Tonya Blowers**

I spent the past 2 years developing communications curricula for PhD students. Scientists in general have difficulty in communicating their work as they tend to focus on the details rather than the big picture. We therefore organise workshops to teach them to pitch their research to different audiences. Mentoring programmes are also very important in this respect.

### **Gretchen Kalonji**

A focus on transforming the curriculum in primary schools is critical. UNESCO promotes low cost experimental tools for that purpose, and works with teachers in developing countries on the use of those tools. We also work with organisations that have experience with hands-on, inquiry-based science education. The institutions responsible for training teachers must also be exposed to these new ways of teaching science, and UNESCO can play a role here. Regarding communications, it should also be possible to incorporate communication subjects into curricula, and oral and written communication could become part of the assessment for engineers.

### **Maha Ayoub**

It is not easy to find the right work-life balance in Tunisia. In my experience, women often have to recourse to in-laws, parents and extended family as school timetables are not at all aligned with working hours. Tunisia has made enormous strides in gender equality but that is not enough to overcome the lack of alignment between the education system and working hours. As a result, women constantly feel guilty about not being there for their families; or they feel they are not pulling their weight at work. When I worked in the UN, for example, all

meetings were systematically organised after 4.00pm which was not at all gender friendly for women.

Second, I would not be here today without the support and open mindedness of my husband, and we cannot ignore the role of the family and society in backing up government policies. In Sudan, for example, gender equality policies have been introduced but women are still far from making up 50% of the workforce. It is not because women are not brilliant enough; it is because they cannot manage both family and career. These institutional issues have to be faced if women are to enter the engineering workforce.

#### **Anne Wangari Kirima-Muchoki**

I believe that having women in decision-making forums is a crucial requirement. Kenya has introduced a constitutional requirement to have at least one-third of all government positions at every level held by women. That is the only way to address women's issues. The situation is of course so much better than it was in the past and our own daughters are able to see female ministers and know that they can aspire to any position they like. We now have a legal basis on which to work, and the impact of that has been tremendous. We are seeing the impact of that cascading down throughout society.

#### **Gretchen Kalonji**

Women tend to be more interested in the life sciences partly because they are more socially acceptable. It could also be related to the desire to do something to help people. The flip side of that is that the life sciences are also changing and becoming more mathematical. That offers an extraordinary opportunity to do some creative restructuring of the curricula of life sciences departments. My own field of material science and engineering also attracts a disproportionately higher level of women as compared to chemical engineering or computing.

#### **Lidia Brito**

45% of forestry engineers in Mozambique are women and we do not really know why. We should also consider the importance of the media, which does not portray the engineering field as it really is. My division in UNESCO is trying to engage with the media to change that. There is also the problem of the structural issues faced by education systems in developing countries in particular. It is more expensive to train science teachers, and therefore schools in poor rural areas often do not have science teachers.

#### **Mozambique Ambassador to UNESCO**

In Mozambique, it is statistically clear that girls are overtaking boys in all areas of education. Mozambique has a long history of women in science and architecture, for example, but not in mechanical or civil engineering. Mozambique has removed barriers to women in education but they are still not entering the fields of civil and mechanical engineering.

#### **Barbara Jinks, Gas Industry, Australia**

Communication is an advantage for girls who are generally better at communicating. I would like to commend Tonya Blowers who has done much with so little funding. In 1995, an Australian association was responsible for sending a video to all schools showing women in fields such as bricklaying or engineering. That was relatively inexpensive but it had an enormous impact in opening up career options as perceived by girls.

#### **Fadwa Abu Ghaida**

I suggest that we focus on three aspects. First, training in communication, leadership and interpersonal skills. Second, we need to have more data in this field as we currently only rely

on our personal observations. Third, we need to increase our networking among women. We all face a number of common challenges and would benefit from each other's experience and good practices around the world.

**Professor of Mathematics, US (of Polish origin)**

I am a professor of mathematics in the United States where we have had a major focus on redesigning our courses. I teach 500 engineering students introductory calculus and this is the first time that I have started off my lectures with interactive, problem-solving exercises. Interdisciplinary education is also of great interest to women, and many universities are opening up to such interdisciplinary work. I am very proud to say that I have never lost one single woman in any course that I have taught for 45 years.

**Marie Helen Ondborg, Swedish Delegation**

Gender equality is a global priority for UNESCO in all activities, sectors and programmes. Gender equality is a high priority issue for Sweden. However, while we have come far in many areas, we are still struggling to attract girls to STEM subjects. In addition, since 1995, we have had problems attracting boys to these subjects. I therefore believe it all comes down to communication, pedagogy, and teaching methods. For young people today, it is simply not cool enough to be engaged in science or engineering, and that is an issue we have to take very seriously.

**Lidia Brito**

That is in fact a worldwide trend with few exceptions. Within the African continent, only Ethiopia seems to be increasing the percentage of students in STEM subjects. I will now ask the panellists to provide their final comments.

**Tonya Blowers**

Subjects like life sciences and agriculture are perceived as being closely linked to development issues. However, people are not making the link with mathematics as the fundamental foundation of so many engineering products.

An important lesson for women to learn is that if you do not ask you do not get!

Regarding the work-life balance, we cannot predict the issues that women face. In the UK child care is incredibly expensive and a major obstacle to women entering the workforce. In the developing world, extended families are able to provide child care but women are more in need of mobile phones to remain in touch with their families.

**Anne Wangari Kirima-Muchoki**

A simple video can have enormous impact in showing people a vision of what is possible. Just the presence at a prize giving ceremony or seeing a woman in a position of power can have a positive effect for girls. Women's societies are forming in Kenya, and allowing women to provide support to each other. Regarding the general decline in interest in science and technology, there is clearly a need to jazz this sector up and make it attractive to both boys and girls.

**Maha Ayoub**

I regret that I did not have a math teacher as inspiring as the one who spoke earlier!

**Gretchen Kalonji**

The development of leadership skills has to start early, and should be incorporated into team-based and project-based pedagogy methods. We also need an open mind as to what leadership

means – women have different leadership skills that can also be very effective. In terms of the work-life balance, we should not forget that things that are good for women are also good for men.

**Lidia Brito**

I will now close our Roundtable. Going forward, we will hopefully be able to work with you in progressing some of the ideas that have emerged today through the UNESCO Engineering Initiative and through our work with the IGU.

**Gretchen Kalonji**

I am very pleased to have been involved in this first forum co-organised with the IGU, and hope it is the start of much to come.



# **Roundtable on Women in Engineering in the Arab States: Identifying Best Practices for Attracting Women to Careers in Engineering**

Moderator: Eng. Khaled Abu Bakr

*Chairman, TAQA Arabia, Egypt, and Regional Coordinator, Middle East and Africa, IGU*

It is an honour to be here today in conjunction with such a respected institution as UNESCO. The participation of women in the workforce in Arab countries is the lowest in the world, and that figure is even lower for the engineering field. Women played a major role in the Arab Spring. However, the potential of those movements has not been realised in terms of women's rights and gender equality. This Roundtable will be concerned with the social, cultural and legal values that prevent greater employment of women engineers in Arab states. It will also consider the positive effects of role models, which were already highlighted in this morning's session.

I am honoured to be surrounded by such a panel of experts: • the Honourable Dr Laila Rashed Iskandar, Minister of State for Environmental Affairs, Egypt – a genuine warrior in Egypt's current, difficult transition period • Dr Amina Benkhadra, General Director, National Office of Hydrocarbons and Mines, Morocco • Dr Fareeha Zafar, Government College University, Pakistan • Eng. Fadwa Abu Ghaida, President, Arab Women Engineers Committee, Federation of Arab Engineers.

## **The Honourable Dr Laila Rashed Iskandar, Minister of State for Environmental Affairs, Egypt**

I am pleased to advise that the new Egyptian constitution has just been drafted and we are once again on the road to becoming a stable country.

When I returned to Egypt from the Silicon Valley, the big question for me was whether the bright children I came across in Egypt's villages would end up like my bright students in Silicon Valley. This got me thinking about what we are teaching our engineers in engineering schools. I found that these young girls may not be formally educated but they know a lot about biodiversity, ecology and waste recovery management. That knowledge is referred to as "local knowledge" rather than science even though it is extremely valuable in preserving our natural resources. In contrast "real science" is often responsible for destroying our environment.

How can we teach geometry to these female engineers who do not have an education? We worked with engineers, architects and designers who felt that their jobs had been emptied of meaning. They worked with these women to convert rags to patchwork quilts, in the process teaching them the necessary mathematical and geometric skills.

Most of these women could not read or write. However, I would argue that they are not illiterate and indeed UNESCO has developed a concept of multiple literacies. We have to take into account the fact that masses of girls will not go to school but will still be able to learn something. It is all a question of how we teach and what we teach. We were able to adapt the Montessori methods to this adult population, and they then went on to become teachers themselves.

The dilemma is this: what are we going to teach these young girls as they become women? We want to produce women engineers in the slums and in poor rural areas, rather than waiting for the day when they might go to school.

**Dr Amina Benkhadra, General Director, National Office of Hydrocarbons and Mines, Morocco**

The world needs to mobilise all its resources – men and women – in addressing all the issues it faces, be they climate change, energy depletion, or food and water shortages.

Morocco is an Arab-speaking, developing country where over 50% of the population is female. Government policy reforms were launched by the King and by the work of women's associations, leading to important improvements in family law and in efforts towards gender parity. A 2006 law brought in quotas on the proportion of women in political parties. A new constitution in 2011 also increased gender parity, and a Committee on Gender Parity was set up. A law on Gender Parity is being drafted for introduction in 2014.

As of today, we have 1 female Counsellor to the King, 5 female ministers, 13 female ambassadors, female security agents, and 250 female religious teachers. This demonstrates that there is a political will for change. Civil society is also very active in this area. In science and technology, we have already seen a positive change. 40% of teachers are women, and 30% of students in preparatory engineering schools are women – an enormous improvement on the 2 women out of 60 students that I experienced in the mid-1970s when I began my training. Young Moroccan women now work in highly technical fields such as the mining industry. All of these are encouraging developments.

Nevertheless, despite all that progress and all our efforts, there is still much room for improvement. To that end, we can focus on a number of areas. First, the low level of school attendance, particularly in rural areas. Second, the family environment is extremely important for young girls, and the work-life balance is very important for working women who are also mothers. Third, the issue of cultural stereotypes, where it is necessary to completely change mindsets and mentalities. That takes a lot of time and has to be done step by step. The way young girls are brought up is key here. The more they are taught that they have an active part to play in society, the more we will see them enter scientific and technical areas. It is up to mothers to pass on that message to their children. Fourth, the lack of role models. There are a few women who have succeeded in scientific careers but they remain a small minority. As early as primary school, it is necessary to give young girls a taste for science. There is also a lack of awareness in the media, which continues to portray women according to traditional stereotypes.

The education system has to be overhauled, and we need to introduce leadership training to help women up the corporate, academic and political ladders. A policy of affirmative action is also needed. In summary, we need to work at several different levels in addressing these issues: in the schools, in families and society, in politics and government, and at the corporate level.

**Eng. Fadwa Abu Ghaida, President, Arab Women Engineers Committee, Federation of Arab Engineers**

A huge development in technology and communication has occurred in the last 25 years and that has made it easier for women to enter the engineering field. The current political changes underway in most Arab states have also placed women's issues at the forefront of the political

agenda. It is time for women to take this opportunity to improve their career options for themselves and future generations.

The statistics are rather limited but they show that 50-60% of students in engineering universities in some Arab countries are female. However, the figure varies and is lower in some countries, such as Yemen, with 6-17%.

The Arab Women Engineers Committee (AWEC) was founded in 2010 and is based in Jordan. It is made up of distinguished women engineers from Arab states and provides support to women engineers, enabling them to gain recognition in their profession. It also helps them reach decision-making positions in government or senior management. It provides a forum for the exchange of experience and best practices among women from different countries, and it focuses on the important role played by women engineers in making a contribution to society. The AWEC organises an Annual Symposium of Arab Women Engineers that aims to address common issues and challenges for women engineers in the Arab States. It conducts special training courses and workshops focused on soft skills such as leadership and communication. It is building up electronic communication and social networks, and has launched the Media Year of Arab Women Engineers to highlight the achievements and contributions made by this population. In this way, it aims to provide positive role models for girls.

The challenges faced by women engineers include social stereotypes, cultural conditions, the workplace environment, a lack of training, a lack of policies to encourage female retention, and an issue of low self-confidence among women engineers themselves.

Women engineers can be empowered in a number of ways including through an appropriate physical and legal environment and a good work-life balance. Training and networking is also important, at the national and international levels. Finally, it is necessary to have policies and practical tools that enable women engineers to reach decision-making positions.

**Dr Fareeha Zafar, Government College University, Pakistan**

In 2004, when I was 25 years old my father gave me a choice between getting married or obtaining a PhD. I chose the PhD – a choice I have never regretted. I was later divorced because I gave birth to a girl and was more educated than my husband.

In terms of Islam and education, the Koran insists on learning, on the basis that both religion and science come from god. Gender inequality exists but it is not limited to Muslim countries – some Muslim countries actually have better levels of women in higher education than non-Muslim countries. A real challenge is the contradictory image we project of women in our societies. Who has not bought a doll for a young girl? Women are associated with delicacy and encouraged to develop soft skills. There is a lack of role models, especially in their early years. There are also financial issues – education is expensive and some families prefer to spend that money on dowries. The Sharia law has caused the entire region to lose its competitive advantage because it denies women an equal place in the work force – or even the ability to drive to work. Finally, there are many stereotypes that have to be addressed.

Women therefore opt for fields that ensure they are protected from all the above factors. Their numbers remain low in engineering although their proportion in the sciences generally is increasing. Arfa Kareem, a Microsoft Certified professional has become an inspiration for young girls in Pakistan. I am currently working with 3 universities in Pakistan and there has been an enormous increase in the number of women enrolled in scientific disciplines.

How can we achieve more? Banks can provide scholarships for women to continue their education. Engineering subjects can be introduced to girls-only educational institutions. The enrolment and retention rates of girls can be increased through incentives, campaigns, the development of curricula and teaching materials, and e-learning. All public boards could be required to have a certain proportion of women – that would be a huge step forward for Muslim women. Appropriate work opportunities and a good work-life balance should be provided. Anti-harassment laws would also encourage more women to enter the workforce. Finally, there is the question of male attitudes, and the extent to which men want their wives and daughters to be dependent on them has to be addressed.

In conclusion, getting women into science education is important. Getting women into the scientific workforce is important. However, the most crucial issue is ensuring they remain in the workforce in a sustainable manner once they have graduated and once they have had children.

**Khaled Abu Bakr**

*[Video presentation on women engineers in the Arab States.]*

Your approach to women who are engineers without degrees is very interesting. What can UNESCO and the IGU do to help in this area?

**Laila Rashed Iskandar**

We face an energy crunch in Egypt at the same time as we have a major resource in the form of animal manure that can be used to produce biogas. That is an area where we can have a huge impact by teaching women to produce energy from animal waste. It is difficult for multinationals to think of such small, local solutions but that is exactly what we need.

**Khaled Abu Bakr**

What policies could be used to provide support to these women?

**Laila Rashed Iskandar**

We need a parallel track. We cannot simply wait for these girls to have the opportunity to go to school or we will lose them for another generation at least.

**Khaled Abu Bakr**

I will now open the floor to questions and comments from the floor.

**From the floor**

Many observers claim that women in Muslim countries are making the slowest progress towards gender equality, and this is said to be the result of the Muslim religion. What can the industrial and corporate world do in this area to see religion as an opportunity and not a barrier?

**Fareeha Zahar**

Religion has nothing to do with a person's ability. The industrial and corporate sector should be able to accommodate the religion and religious practices of its employees within reasonable limits. Religion should not be seen an obstacle here.

**Laurie Chawick, American Gas Association**

Men also have to be comfortable with their expectations. In the US, significant progress has been made but there are still some areas where men think as they did in the distant past. It

takes a long time to change these mind sets. In your experience, are men in the Arab states becoming more comfortable with non-traditional roles for men and women?

**Fareeha Zahar**

They are not comfortable but they are trying to adjust. For example, some men seek out highly educated women for their earning potential. At the end of the day, however, they do not consider women as the principal breadwinner.

**From the floor**

If we want more women in our companies it is also up to companies to attract and retain women by offering them genuine career paths. My company has launched mentoring programmes that are specifically dedicated to women, preparing them for senior positions in the future. Without that we cannot succeed in attracting and retaining women.

**Fadwa Abu Ghaida**

Women are expected to be perfect in the home and perfect at work. However, everyone makes mistakes – men and women – and we need to teach children that it is OK to make mistakes. This is also a question of sharing responsibility and self-confidence, and is particularly important for girls.

**Khaled Abu Bakr**

What are the main obstacles in the Arab world to getting women into decision-making positions?

**Amina Benkhadra**

First, you need to have competent women and you need political will at the highest level. In 1997, King appointed 4 ministers for the very first time. In 2011, when political parties were able to choose their ministers, only 1 woman was appointed. Today, political leaders in Arab countries still prefer to appoint men. Nevertheless, civil society has become very mobilised in defending the presence of women at the highest levels of government and business.

**Maha Ayoub**

No one has mentioned the question of the spaces where Muslim women cannot go. In our culture, there are many areas to which women have no access and these are places where much politicking and negotiation takes place – for example when going to the mosque with men only. How can we, as women, position ourselves in the use of these mechanisms?

**Amina Benkhadra**

These male networks are clearly very important but women can also organise their own networks. Women have tended to be less ambitious in mobilizing networks to their advantage. When offered the choice between a woman and a man, political parties in Morocco will always opt for the man and much work is still needed here.

**Fadwa Abu Ghaida**

Women should work together to address such issues. At times, we do not provide each other with enough support. Together we can make a difference, for example, through a Leadership Council. Many laws could help women (for instance the provision of child care facilities) but these laws are not being enacted because women are not present in the decision-making forums.

**Khaled Abu Bakr**

I will now invite our panellists to sum up the discussions.

**Fareeha Zahar**

Social and mobile media can overcome the problem of men-only spaces. We could have more role models in politics and in industry, with women in leadership positions. That will require the imposition of quotas. Governments and higher education institutions could do more to ensure that women do actually enter the workforce once they graduate.

**Amina Benkhadra**

If we want to support women and help them develop in science and technology and in the corporate world, we have to combat stereotypes and prejudices. We have to take on board gender parity in all policies: educational policies and corporate policies. Education curricula have to be overhauled and stereotypes removed. In the media, more space should be given to successful women. In the political world, women should be represented at all levels, and this will also require the introduction of quotas. In the corporate world, once women attain managerial responsibilities, their environment should support their career development. Women must be more present on company boards, both in the developing and developed worlds.

We have to act at all levels: school, society, home, politics, and the corporate world.

**Fadwa Abu Ghaida**

The greatest obstacle we face is in achieving the right work-life balance that enables women to progress in their careers while raising families. Part-time or working from home should be an option here, together with the provision of childcare. Most importantly, women have to have access to decision-making positions.

**Khaled Abu Bakr**

Message received – Houston we hear you! I would also hope that we would be able to bring more men and decision-makers to such meetings as these in order to raise awareness about the challenges and stakes involved.

## Conclusion

Ms Saniye Gülser Corat

*Director, Division for Gender Equality, UNESCO*

It is a great pleasure to be present at the closing of this important workshop on women engineers in Africa and the Arab States. The issues of science education and gender equality lie at the core of UNESCO's priorities.

A recent New York Exhibition featured 32 women who made major contributions to science from the 17<sup>th</sup> century onwards. Some are very famous but many are not; only 9 were Nobel Prize winners. The key message of the exhibition was that these women are all the more extraordinary given the deeply entrenched biases they had to overcome – be they within their own families or their own societies. At the same time, they also had mentors and champions who opened doors to these richly deserving women.

When it comes to science and engineering, where are the women? Where are they getting lost and why? In 2013 many women still lack vital skills like literacy – they represent two-thirds of the world's illiterate and that ratio has not changed in the past 20 years. Girls are still less likely to enter primary schools than boys, and the gap widens even further at the secondary school level where the drop-out rate for girls has in fact increased. In most regions of the world, women are more likely to be uneducated than men, and that applies even more so in the scientific and technical fields.

At the tertiary level, the pipe leaks even further. Engineering and computing science are almost exclusively male preserves, although the life sciences, including medicine, are dominated by women in 75% of countries. At the masters and doctorate levels, the pipe leaks even faster. Women account for just over 25% of the world's researchers. In some parts of the world, gender parity has almost been reached. In Europe, the highest percentage of women scientists is to be found in Latvia, and the lowest in the Netherlands. Only 0.5% of the world's researchers live in the least developed countries, and the ratio of women to men is lowest in all of the least developed countries.

Why do we have so few women in science, technology and engineering? There is a major issue of stereotypes and attitudes to women in science, and these exist at the subconscious level. As one woman scientist put it: "Equal talent and accomplishment are viewed as unequal when seen through the eyes of prejudice". The media also plays a significant (and negative) role here, reinforcing the idea that science is the preserve of men and boys. Here too, women are underrepresented in decision-making. It is also important to train teachers to recognise their own negative stereotypes, and to remove gender bias from school manuals.

The school to work transition is another area where women leave in great numbers, and mentoring, networks and role models can play a positive role here. Finally, the work-life balance is an important issue. Some women make the choice to reject the long hours, field work and travel associated with ambitious careers in science.

UNESCO now strives to mainstream gender equality into all the work it does. In that way, all that we do and every action we take becomes an action in favour of gender equality and, directly or indirectly, helps find those women who are currently missing from science.

I would like to thank all our participants and distinguished panellists for tackling this issue. UNESCO and the IGU Task Force will work together to draft a report based on the conclusions of these Roundtables. The policy recommendations from that Report will be reviewed at the World Gas Conference to be held in June 2015. I sincerely hope that this will help us take a further step in promoting women in science, technology and engineering.

**Jérôme Ferrier, President, IGU**

Before parting, I would like to thank our panellists for their contributions. I also thank UNESCO for supporting this workshop and particularly Mrs Gretchen Kalonji, ADG for the Natural Sciences, and Mrs Saniye Gülser Corat, Director of the Gender Equality Division, for their presence at this closing. I hope that IGU will be able to reflect further on these issues as we go forward, and trust that this event will mark the beginning of a longstanding cooperation between our organization and UNESCO.



## Biographical Notes



**Irina Bokova, Director-General of UNESCO**

Irina Bokova took office as UNESCO's Director-General in November 2009. She was previously Ambassador of the Republic of Bulgaria to France and Monaco, Personal Representative of the Bulgarian President to the "Organisation Internationale de la Francophonie" and Permanent Delegate to UNESCO from 2005 to 2009. She has been actively engaged throughout her career in international efforts to advance the rights of girls and women, and participated in the World Conferences on Women organized in Copenhagen (1980), Nairobi (1985) and Beijing (1995). She considers gender equality to be one of the most important political and humanistic goals of our times, and launched a Global Partnership for Girls' and Women's Education and a High-Level Panel in May 2011 to galvanize support and step up global advocacy for gender equality.



**Jérôme Ferrier, President of the International Gas Union**

Jérôme Ferrier, President of the International Gas Union, is Senior Vice President of Total, a major International oil & gas company. A petroleum engineer, he held successive positions of responsibility in the supply, transport, storage and marketing of gas, in the past 25 years including as CEO of Gaz du Sud Ouest and president of Gas & Power in South America.

## **Roundtable on Women in Engineering in Africa: Enticing Young Women into STEM Education**



**Ambassador Maha Ayoub, Representative of Sudan to UNESCO**

Ambassador Maha Ayoub is one of a handful of Sudanese women who have forged their way through the uncharted territory of men, in a conservative Muslim society, to scale the higher echelons of diplomacy. Born in Boston, Ambassador Ayoub grew up in the US, Britain, Sudan, Iran, Oman, Italy and Egypt, and also lived in France and Tunisia. Her wide-ranging career includes a year as a volunteer in Darfur with displaced communities and refugees during the 1986 East Africa famine, and several as a program officer with UNDP and FAO working in sustainable development and gender equality. A graduate of the American University in Cairo, where she studied Middle Eastern Studies, Ms. Ayoub did her graduate work in Sociology, and later in International Law at the Sorbonne. Her 2011 novel “Nile Blues”, (now in its 3rd printing) on women and the separation of Sudan received critical acclaim and earned her a speakership on TEDx.



**Ms. Anne Wangari Kirima-Muchoki, Chairperson, Kenya Investment Authority**

Anne Wangari Kirima-Muchoki serves as Chairperson of the Kenya Investment Authority. Ms. Muchoki received a degree in Politics and Economics from the University of London, a Master’s degree in Commercial Property Management from Liverpool John Moores University and an MBA from Brunel University. She is a chartered surveyor, an associate member of the Royal Institute of Chartered Surveyors (ARICS), a member of the Commonwealth Association of Surveying and Land Economy (CASLE) and a registered real estate agent in Kenya. She has held senior positions such as Director of Kenya Commercial Bank (Rwanda), Commissioner of Illegal and Irregular Land Allocation in Kenya (appointed by the President of the Republic of Kenya), Director of Added Value Group, Group Director of Kirima Trust (Kenya and UK),

Director of Regent Group (Kenya), Director of Migaa residential facility, and Director of Mambui Golf Resort. Ms. Muchoki has been a member of the Local Organising Committee to ISK/CASLE/UN Habitat Regional Seminar/Workshop on Security of Land Tenure and the Internal Committee for Computerisation of Lands Records, Ministry of Lands and Settlement.



**Dr. Tonya Blowers, Programme Coordinator, Organization for Women in Science in the Developing World**

Tonya Blowers is Programme Coordinator for the Organization for Women in Science for the Developing World (OWSD) based in Trieste, Italy. She has a Ph.D. in Women and Gender from the University of Warwick (UK) and has developed science communication courses for Ph.D. students in neuroscience, biology, physics and mathematics. Before joining OWSD, Tonya was a staff writer at TWAS (The World Academy of Sciences for the Advancement of Science in Developing Countries), contributing many articles and editing the TWAS newsletter.



**Dr. Gretchen Kalonji, Assistant Director-General for Natural Sciences, UNESCO**

Gretchen Kalonji is the first woman to hold the position of Assistant Director-General for Natural Sciences in UNESCO. An American materials scientist, Dr. Kalonji's work has focused on two main themes: transformation of engineering education, with a particular focus on women and underrepresented minority groups and new models for the more effective internationalization of universities. She is strongly committed to promoting science in Africa and has worked with several African universities. Professor Kalonji was the first woman to hold an endowed chair – the Kyocera Professor of Materials Science and Engineering at the University of Washington (UW) Seattle and she also served as Assistant and Associate Professor in the Department of Material Science and Engineering at the Massachusetts Institute of Technology (MIT). Professor Kalonji has held visiting faculty appointments at numerous universities and institutes around the world and she serves on numerous national and international advisory boards and committees, particularly for projects and organizations focusing on innovations in education, equity and access in higher education, and international science and engineering.



**Dr. Lidia Brito,**  
**Director of Division of Science Policy and Capacity Building, UNESCO**

Lidia Brito is the Director of Science Policy and Capacity Building in the UNESCO Natural Sciences sector. She was born in Mozambique, has a Doctorate in Forest and Wood Science from Colorado State University in the USA, and is a Professor for Wood Science at Eduardo Mondlane University in Mozambique. She has held senior positions such as Vice-Rector for Academic Affairs of Eduardo Mondlane University, Minister for Higher Education, Science and Technology of Mozambique, and Advisor for Strategic Planning and External Relations of the Mayor of Maputo City. Her areas of expertise range from forestry and sustainable management of natural resources to higher education, science and technology public policies for sustainable development. She has chaired several commissions and task teams in particular on Higher Education, STI and ICT for Sustainable Development. She has been and still is a member of several international Boards including UNU Council, SciDev Trustee Board, CPRS of ICSU, African Foresters Forum Governing Board, GeSci Advisory Board and SEI Governing Board among others.

### **Roundtable on Women in Engineering in the Arab States: Identifying Best Practices for Attracting Women to Careers in Engineering**



**Honorable Dr. Laila Rashed Iskandar,**  
**Minister of State for Environmental Affairs, Egypt**

Dr. Laila Iskandar is the Chairperson of CID Consulting, which was awarded the "Social Entrepreneur of the Year" award in 2006 at the World Economic Forum by the Schwab Foundation. CID Consulting was established in 1995 with the mission of developing individuals, organizations and communities by empowering them to grow dynamically, manage more efficiently and communicate effectively. She studied economics, political science at Cairo University, Near Eastern studies and international education development at UC Berkeley and Columbia University. Dr. Iskandar was consultant to the Minister of Environment on solid waste management issues in Egypt. She has worked with the informal waste sector for over 30 years and has designed, developed and implemented community based solid waste projects and new material recovery facilities (MRFs). She is also an expert in the social development aspects of solid waste management. She has received awards for

community based projects for women, youths and children encompassing learning and earning approaches. Her experience straddles the fence of formal and non-formal education, international development and grass roots community mobilization.



**Dr. Amina Benkhadra,  
General Director of the National Office of Hydrocarbons and Mines,  
Former Minister in Charge of Energy, Mines, Water and Environment, Morocco**

Dr. Benkhadra is the General Director of the National Office of Hydrocarbons and Mines (ONHYM), Morocco. She is the former Minister in charge of Energy, Mines, Water and Environment and the former Secretary of State responsible for mining sector development for Morocco. Dr. Benkhadra has a degree in Civil Engineering of Mines from the National Superior School of Mines at Nancy and a Doctorate of Engineering in Mine Sciences and Techniques (ENSM Paris). She began her career at the Mines Research and Participation Office (BRPM) where she held several positions of responsibility in the feasibility of mining projects. In 1994, she was appointed Director of Mines at the Ministry in charge of Energy, Mines, Water and Environment, then Secretary of State in charge of mining sector development (1997-1998). She became Director of the BRPM in 1998, then General Director of the National Office of Oil Research and Exploitation (ONAREP) from August 2000 to November 2003, before getting appointed as General Director of the National Office of Hydrocarbons and Mines in November 2003. She supervised the creation project of the ONHYM, which combined the BRPM and ONAREP offices. In October 2007, she was appointed as Minister in charge of Energy, Mines, Water and Environment.



**Dr. Fareeha Zafar, Government College University, Pakistan**

Dr. Fareeha Zafar is employed with the Higher Education Commission (HEC) Pakistan and has an appointment at Government College University, Pakistan. She earned a Ph.D. in Computer Science specializing in Mobile Cellular Networks (Telecom) from the University of Derby-United Kingdom. She also has an MBA-Human Resource Management from the UK. She is Director of the Department of Computer Science and in charge of the Ph.D. program at Government College University, Pakistan. Dr. Zafar supervises 5 Ph.D. scholars in Cellular Technology and 192 M.Phil. students in Telecommunications/Computer Science & Business Studies. She is the Vice President of the NGO, Humanity Welfare Service Foundation (HWCF) that works on provision of education, health care, free treatments, emergency relief,

and rehabilitation across Pakistan and she is a member of UNESCO World Heritage Site project planning and development.



**Eng. Fadwa Abu Ghaida, President, Arab Women Engineers Committee, Federation of Arab Engineers**

Eng. Fadwa Abu Ghaida is the President of the Arab Women Engineers Committee of the Federation of Arab Engineers and a Manager of the Organization Development unit at Mostaqbal Engineering and Environmental Consultants. Eng. Abu Ghaida has a B.S. degree in Architecture Engineering from Jordan University and a Master's degree in Executive Enterprising Management from Durham University-UK. She has professional experience in project management, strategic planning, enterprise management and development, capacity building and training, knowledge management and extensive experience in building design and landscape design. Eng. Abu Ghaida is also an active member of numerous professional and non-governmental associations such as Jordan Engineers Association, Jordan Society of Architects, Women in Engineering Committee of the World Federation of Engineering Organizations and Architectural Engineering Branch of Jordanian Engineering Association among others.



**Eng. Khaled Abu Bakr, Executive Chairman of TAQA Arabia, Egypt, and the Middle East and Africa Regional Coordinator, International Gas Union**

Eng. Khaled AbuBakr is the Executive Chairman of TAQA Arabia, the largest private sector energy distribution company in Egypt with over 16 years of experience in investing and operating energy infrastructure, gas transmission and distribution, power generation and distribution and retail marketing of petroleum products and operations. He co-founded the Gas & Energy Group and led the company as Vice Chairman and Managing Director. In 2006, he co-founded TAQA Arabia with Citadel Capital. Eng. AbuBakr is also the Middle East and Africa Regional Coordinator for the International Gas Union (IGU), the Chairman of the Energy Committee in the American Chamber of Commerce Egypt, Chairman of the official "Italian Egyptian Business Council" and a member of the International Advisory Board of the HEC/University of Montreal.



**Saniye Gülser Corat, Director of Division for Gender Equality, UNESCO**

Before joining UNESCO in 2004, Gülser Corat pursued a dual career in the academe and in international development. Her academic work included research and teaching in the field of political economy. As an international development practitioner, she was a senior development advisor for various bilateral development agencies, for multi-lateral lending institutions (the World Bank and the Asian Development Bank), UN agencies (UNDP and UNCTAD) and for civil society organizations, especially in Asia and Africa. She also has private sector experience as the CEO of an international consulting company (ECI Consulting, Inc.) in Canada.

## **IGU/UNESCO Roundtable on Women in Engineering Concept paper**

### **1. Background**

For nearly three decades, governments and industries across the industrialized world have sponsored efforts to increase the representation of women in professional engineering, recognizing the (largely) untapped pool of talent amongst women. These efforts have had some impact, but engineering remains a heavily male-dominated occupation in most countries. There is clearly room for improvement – not only in recruiting women into engineering, but also in retaining and promoting those women who do enter the profession.

Given the current and future global need for engineering, it is imperative that all human resources are used. Yet, historically, women have been significantly underrepresented in engineering fields, typically making up only 10 – 20% of the engineering work force. In some European countries these figures are higher with Latvia having 30% of female engineers and Sweden 26%, but percentages drop for Ireland 14%, India 12% and the United Kingdom 8.7%. In Africa, South Africa has typically around 10% of women in the engineering workforce while Kenya has a representation of 8% of women engineers. There is an increase in the uptake of women studying Science, Technology and Innovation (STI) which is positive. In the USA and Europe, women now make up around 30% of the engineering students enrolled at university, in India it is 35%, in South Africa the representation is 15% whereas in the Gulf region (such as Kuwait) women make up around 60% of the engineering students at university. However, even in countries where the numbers of women studying STI have increased, it has not translated into more women in the workplace. Many students who graduate do not go into the engineering profession due to many different factors based on cultural beliefs and religion.

It is evident that there is a need to encourage more women to study engineering and to enter the engineering workforce. Women face diverse challenges when pursuing an engineering education and when deciding to apply for engineering jobs, both within the academia or private sector. Educational constraints, cultural norms and prejudices influence opportunities and choices, severely reducing the number of women engineers who are employed in their field of expertise.

This workshop intends to shed light on these constraints, focusing on concrete recommendations to improve the cultural and social conditions in which African and Arab will-be female engineers live and will develop their educational and professional careers.



## **2. Workshop**

### **2.1 Overview**

A workshop consisting of two round-tables will be organized in Paris during the second week of December 2013 (around 10 December), concentrating on the regions of Africa and Arab States. The issues to be addressed are:

- The education system and what the constraints are for women which prevent them from studying engineering
- What are the career environments that prevent women from entering the engineering workforce
- Examining what the national policies and company policies are that could affect women's participation

### **2.2 Objectives**

The objective of the workshop is to formulate a report which will outline the socio-economic, cultural and educational constraints for women in engineering in Africa and the Arab States, as well as the opportunities for their inclusion in the engineering workforce in these regions.

### **2.3 Round-Table**

There will be two round-tables which will discuss the issue of women in engineering in Africa and then in the Arab States.

#### 2.3.1 The challenges of STEM education in Africa, particularly for women

- The panel will be made up of around six experts from Africa who work on the issue of women in engineering with the appropriate gender balance.
- Ideally the panel should consist of two educational/institutional experts, two industrial/private sector experts and two NGO/CSO/volunteer group experts
- Issues of education policies, STEM education in curricula, hands-on training and learning, mathematics and science teachers and their focus, increasing the participation of girls in STEM education, increasing the number of female students studying engineering.
- Analysing the participation of women engineers in the workforce and the policy related constraints to their greater representation

#### 2.3.2 Women in engineering in the Arab States - how to entice them into the energy sector

The panel will be made up of around six experts from the Arab States/Gulf regions who work on the issue of women in engineering with the appropriate gender balance.

- Ideally the panel should consist of two educational/institutional experts, two industrial experts/private sector and two NGO/CSO/volunteer group experts
- It is known that the engineering students in the Arab States are predominantly women, however, the factors that prevent these women from entering the workforce need to be analysed, including policy issues.
- Examine the environment that prevents female engineers from entering the workforce in greater numbers

