



المنتدى الهندسي الخليجي السابع عشر  
THE 17TH GULF ENGINEERING FORUM



جمعية المهندسين العمانيه  
Oman Society of Engineers

# الملتقى الهندسي الخليجي السابع عشر The 17th Gulf Engineering Forum

## Forum Outline Abstracts





# DAY 1

## Opening Session

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9:40

### **Science and Policy for Sustainable Energy**

**Key Note Speaker 1:**

**Pro. Daniel Kammen:**

**University of California**

With 1.4 billion people lacking electricity to light their homes and provide other basic services, or to conduct business, and all of humanity (and particularly the poor) are in need of a decarbonized energy system can close the energy access gap and protect the global climate system.

With particular focus on addressing the energy needs of the underserved, we present an analytical framework informed by historical trends and contemporary technological, social, and

institutional conditions that clarifies the heterogeneous continuum of centralized on-grid electricity, autonomous mini- or community grids, and distributed, individual energy services.

We find that the current day is a unique moment of innovation in decentralized energy networks based on super-efficient end-use technology and low-cost photovoltaic, supported by rapidly spreading information technology, particularly mobile phones. Collectively these disruptive technology systems could rapidly increase energy access, contributing to meeting the Millennium Development Goals for quality of life, while simultaneously driving action towards low-carbon, Earth-sustaining, energy systems.



## Session I

# Energy Resources & Conservation

10:45

## **Waste to Energy: Thermochemical Gasification Pathway**

**Dr. Isam Janajreh:  
Masdar Institute**

Waste-to-Energy through gasification is a tandem environmental solution. It offsets and delays fossil fuel depletion and abates the unconstrained incineration and landfill emissions. Gasification of waste can divert and convert the staggered landfill waste (industrial, medical, municipal, etc.) into a clean hydrogen source, useful chemicals or direct power. It is classified

as a high temperature conversion next to incineration, and pyrolysis distinguishing it from the low temperature conversion technologies that include biophysical transesterification, anaerobic and aerobic digestion as well as fermentation.

This talk will focus on the gasification of a waste feedstock into a stream of clean syngas. In particular, I will present results on the traditional STA curve (proximate analysis) that fraction the feedstock into moisture, volatile, fixed carbon and ash contents. This will be complemented with material characterization using the elemental Flash CHNOS analyzer followed by deduction of a given feedstock molecular unit and heating value. Analysis of several feedstock's that cover the whole range of the O/C vs. H/C curve (known as Van Krevelen diagram) will be shown. Literature based correlation of the chemical stored energy compared to those obtained by the Bomb Calorimeter will be presented.

Starting from the inferred chemical composition a deduction of chemical pathways to predict the reaction



species is sought. Gibbs free energy minimization approach representing an ideal (unlimited chemical and diffusion rates) reactor is carried out first. A comparative results on the syngas yield and gasification metrics of the oxidizer, moderator, and temperature interplay for different feedstock will be presented.

Finally, a high fidelity CFD eddy dissipation/ Finite rate Arrhenius species transport modeling will be presented. Comparison of the species distribution of the high fidelity model to the equilibrium (Gibbs free energy) results as well as available experimental will be discussed.

This progression represents the core competency of my group of waste to energy laboratory at MI. Enabling one to assess the conversion metrics of a given waste feedstock, chose optimal conversion conditions oxidizer moderator for syngas yield, and use the results for innovation in the conversion device (gasifier, reactor, combustor etc.).

## 11:10 **Utilization of Renewable Energy in Oman**

**Eng. Hamad Al-Maghdary:  
Rural Electricity Company**

Renewable energy resources are playing the most important forms of future Globe sustainable and Environment friend Power sources.

Oman is one of the highest solar energy densities in the World in addition to Remarkable potential of Wind in specific Regions, therefore Solar and wind power are presented as the most appropriate options in Oman as per feasibility study conducted and published by AER, Oman in 2008.

To satisfy the recommendations demonstrated by relevant authorities for implementing sustainable environmentally friend energy resources, plans have been established to deploy renewable sources at different areas of Oman.



This presentation presents the potential of renewable energy resources in Oman and the feasibilities and benefits of adopting small and large scale projects

11:35

## Renewable Energy Trends

**Dr. Klaus Dieter Rasch:  
Azur Space Solar Power**

Is there more than PV? The renewable energy future in the region the way from Space to Earth and from silicium to the triple junction Gallium arsenide cell.

Why CPV? Comparison of different PV Technologies: Efficiency, Temperature behavior, degradation, land requirements. Levelized Cost of Energy comparison with an example in Oman.

Energy and Water: Introduction to the various possibilities of systems: CPV: From the high kWp System of Soitec to the small solution CPVRS New developments with combined systems: CHP and CTS

Possibilities in combination with a Water Purification Unit: Dates Program/ Storage possibilities exiting advancements for hybrid solutions: Gas Turbine with CPV.

Different Approach Against the mainstream of Chinese providers AZUR SPACE demonstrates the capabilities with local demonstrators and training of local engineers before any other sales activities. Benefits of local partners and local content. Action Plan Oman: Outlook of short realization: Roadmap renewable energies in Oman.

12:00

## Energy Efficiency & Renewables in PDO

**Dr. Syham Bentouati:  
Petroleum Development Oman**

The talk will describe PDO's efforts in improving its energy efficiency using a four-part strategy, with examples from



each part. Particular emphasis will be on two novel approaches, viz. (a) the solar steam generation pilot for thermal Enhanced Oil Recovery that has just completed its one year operation and sims at gas saving and creating local In-Country Value and (b) the reed beds plant used for treatment of produced water, which has received many regional and global awards and created a whole new eco-system in the middle of the desert.

## Session II

### Energy Resources: Conservation

#### 1:20 **A Grid-Connected Hybrid Renewable Energy Station**

**Dr. Shaker Haji:**  
**University of Bahrain**

The national refining company in Bahrain has established a pilot-scale green energy

station. The station mainly consists of 4 kW photovoltaic modules, a 1.7 kW wind turbine, a 1.2 kW fuel cell system, two 60 NL/h Hydrogen generators (electrolyzes), six 600 NL hydrogen canisters, and four 250 Ah Batteries. The station is also connected to the public grid to meet excessive power demand. In this work, the meteorological and energy related data acquired for a period of one year (May 2010-April2011) are analyzed. Time series analysis is used to model the meteorological data. The energy related data for the various systems involved in the station are analyze for their contributions to the total power generated, environmental effects, performances, and feasibilities.

Based on the available one-year data, the following time series models are found to be satisfactory for modelling the meteorologically related variables: ARIMA(1,0,0) for the wind speed, ARIMA(1,0,0) for the solar radiation, ARIMA(0,1,2)fortheambienttemperature, and ARIMA(1,0,0) for the solar module's temperature. For the energy related one-year date, it is found that 70% of the station's electrical demand is met by the



renewable energy resources while the met is met by the public grid .The share of the solar panel and the wind turbine in the renewable energy mix are found to be 90% and 10%, Respectively. The station saved about 1.5 tonnes of CO<sub>2</sub> over a year and emitted 621 kg of CO<sub>2</sub> due to energy shortage covered by the public grid. The efficiencies of the wind turbine, solar panel, and the fuel cell system are verified to be within reasonable ranges. The solar panels are found to be used more effectively compared to the wind turbine, probably due to their location and orientation. Payback period and net present value calculations are used to assess the economic feasibility of the system. The payback period and cost of produced energy for the solar panels are to be approximately half of that for the wind turbine. However, the cost produced renewable energy is found to be 14 to 150 times more than what a costumer pay for the government-subsidized electricity in Bahrain.

Many other details are investigated and reported in this study. Improvements to the existing systems are also suggested.

# 1:50 Electrical Power System: Losses & Energy Conservation

**Dr. Amer Al-Hinai:  
Masdar Institute**

**Abstract:** Importance of energy efficiency lies in the fact that it ensures provision of same level of energy using fewer amounts of fossil fuels. Owing to the increasing demand and limited availability of fossil fuels, the importance of efficient use of energy has been realized all over the world. The measures of energy efficiency are useful in multiple ways. Reduced use of fossil fuels is essential in lowering the emission of greenhouse gases contributing to global warming. The policies for energy efficiency aim to minimize the use of fossil fuels; thereby prevent the occurrence of adverse climatic change resulting from it. Energy efficiency reduces electricity consumption and helps in saving money.



The demands as well as the unit costs for purchased energy (especially electricity) are increasing rapidly. More than 45% of the energy consumed in the world is used for the heating and/or cooling of domestic and commercial buildings. In the Gulf region, almost 70% of the national electrical-power generated is used in space cooling. Air conditioning system requires huge transfer of reactive power from the utility through the distribution network. The main drawback of this problem is increase in the network losses and reduction in the voltage level. Low voltage profile leads to malfunctioning or reduction in the lifetime of electric devices and increases the internal losses of electric motors; hence decreases the efficiency.

## Session III

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### Resources Crunch

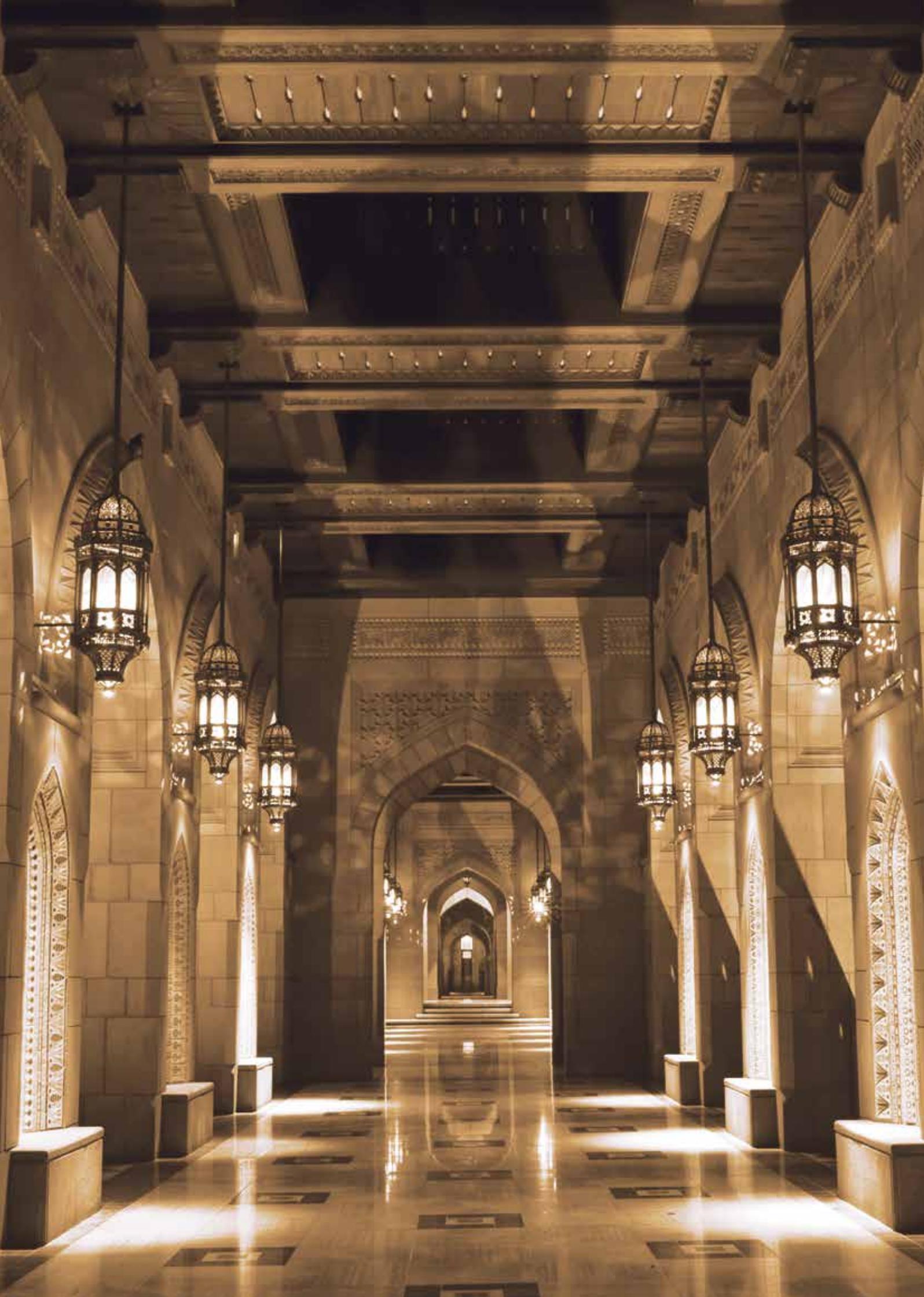
2:20

### **Panel Discussion:**

## **Industry and Governmental: Engineering Solutions for the Resources Crunch**

**Pro. Daniel Kammen, Pro.  
Moses Tade, Eng. Ahmed S.  
Mazrui, Pro. Amer Al-Hinai**





# DAY 2

## Session IV

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### Resources

### Crunch: **Energy & Water**

### 9:00 **Future Strategic Vision on Efficient Utilization of Energy & Water**

**Pro. Moses Tade':  
Curtin University**

The world is currently facing energy and water crisis due to the depletion of fossil fuels and water contamination. Novel strategies and advanced technologies for efficient generation of clean energy and clean water from renewable sources are in high demand. In this talk, we will present our latest research results in

energy conversion, solar energy utilization and wastewater treatment. In addition, we will present our view on strategy for efficient energy utilisation.

It is well known that water shortage is the big issue in the Arabian Gulf countries. Meanwhile strong solar radiation in the regions provides an abundant energy for utilisation. Solar light, with full spectrum of ultraviolet (wavelength  $< 400$  nm, about 5%), visible light ( $400$  nm  $<$  wavelength  $< 750$  nm, 42%), and infrared (wavelength  $> 750$  nm, above 50%), is the largest sustainable energy.

In recent years, we have carried out comprehensive investigations on photocatalysis using solar light for water treatment and CO<sub>2</sub>-biocapturing for biofuel production. We have developed effective semiconductor systems to extend the light absorption into visible light region for more effective utilization of solar energy. In addition, biological processes using microalgae in a direct CO<sub>2</sub> to biomass conversion from point source



emissions of CO<sub>2</sub> in engineered systems such as photo-bioreactors has also been investigated. Such a system can solve both economical and environmental problems while simultaneously producing biofuels or other useful chemicals.

Although the Arab Gulf countries own huge reserves of crude oil and gas which could provide their energy requirements for the next 50 years or more, they should explore the supply of alternative sources of energy for world energy supply and meet the environmental issues. The Gulf countries also have abundant solar energy available and it is an important sustainable energy to oil. For solar energy utilisation, electricity generation based on photovoltaic (PV) technology from light is the best technology, safer than nuclear power generation. Although the cost of generation of electricity by this method is still high compared to utility power generation but it could be further developed to make it available at adequate cost in the future.

Another feasible option is Enhanced Oil Recovery (EOR). It is estimated that

even 1% increase in the recovery factor would yield an increase of 35-55 billion barrels in global oil reserves which could feed the fossil fuel energy hungry world for about two years. It is believed that some of the EOR methods such as CO<sub>2</sub>-EOR could also have noticeable positive environmental impacts if such operations are carried out in conjunction with the widely debated CO<sub>2</sub> geo-sequestration projects.

## Session V

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### Water & Green Initiatives

10:45

### **Notes on Gulf Green Architecture & Urbanism**

**Dr. Ali A. Al-Raouf:  
Qatar University**

Gulf Capital cities need to consider a



more holistic approach for its sustainable strategic development which is based on the principles of knowledge and creative economy. This approach as suggested in the paper is based on both global interpretation and local understanding of the developmental process of "Glocalization" might be more appropriate approaches to Gulf Cities Development to replace the current skin deep and marketing oriented process of "Sustainablization".

This paper calls for a new approach to the development and design process. City planners and decision makers shouldn't be overwhelmed by the state of the art marketing campaigns to promote this limits understanding of sustainability.

Sustainability in the making of cities and architecture is a very comprehensive and holistic concept. It is a multifaceted vision which asserts affordability, social sustainability respect and fosters the cultural diversity. It is also a process by which we can create car free cities, but more importantly, children and women friendly cities.

This paper will provide a different alternative for Gulf Cities architecture and urbanism which considers the conditional value of its past. The Research will invite architects and planners to look at the Gulf's extended past as a generative creative force in the contemporary matrix of articulating the built environment.

## 11:15 **Interior Finishing to Reduce Energy Consumption: Bahrain Experience** **Dr. Saad Fawzi Al-Nuaimi: University of Bahrain**

The increase in energy consumption is becoming increasingly important. This has resulted in a movement towards designing more energy efficient buildings; as it is one of the most significant energy consumers. Buildings alone consume the largest portion of the total electric energy sold in Bahrain (about 81%); most specifically residential buildings are



consuming 54.4% of the total energy use with increasing rate of 7.5% in energy consumption every year. Large portion of this consumption is used to condition buildings for providing thermal comfort. The building envelope is one of the most important systems effecting energy efficiency of a building (e.g. Walls, Windows and the roof).

The main purpose of this research is to identify the effect for nine interior finishing's materials on energy consumption in Bahraini residence; to provide a tool that helps designers to get a better understanding for the effects of these materials and energy conservation. In order to achieve the research objectives, a proposed building evaluation model using eQUEST 3-64 simulation program was used to evaluate and compare the most nine common use interior finishing's materials in Bahrain on energy consumption.

The most common materials have been used for this research were: Slate stone finishing's, Porcelain finishing's, Plaster finishing's, Particle board finishing's,

Stucco finishing's, Granite finishing's, Marble finishing's, Terrazzo tile finishing's and Gypsum Finishing's. The results of the simulation and the comparison find, the best material to be used as a thermal finishing's for the residential buildings in Bahrain, is the gypsum board, which consumes less energy by about (5.5%), less cooling demand for around (5%) and approximately 8% less in ventilation fans demand.

11:45

## **Water Resources & the Challenges in the Sultanate of Oman**

**Dr. Aisha Al-Qurashy:  
Ministry of Regional  
Municipalities & Water  
Resources**

The Sultanate of Oman lies within the areas of the dry belt, which suffers from the lack of rain and scarcity of available water resources. The least the average annual



rainfall is about 100 mm , and with the absence of permanent rivers; the valleys of intermittent flow depends on rainfall intensity and duration ; so the surface water and groundwater are considered scarce compared to the number of the population and the amount of demand.

The growing continuous population, enterprises, climate change and global warming, has led to drought in some areas and flooding in other areas. In addition to the energy crisis, especially in the countries that fall within the dry belt and scarce water resources available, and the difficulty of finding new water sources and protect it from pollution and good management to meet the demands and growing needs of water for drinking and development of various kinds is a major challenge for the state .

The Sultanate's government is focused on and attaches great importance to water resources available and the search for new resources; and to put laws and regulations to ensure the proper management of these resources and to meet the challenges of dry periods

subsequent to ensure a balance between water uses and renewable resources.

The preservation of water resources of attrition, with the provision of portable water to all citizens without interruption, and to provide access to the collection and re-use of treated sewage water, in addition to the provision of water for industrial and commercial uses and agricultural within the limits of available water resources to achieve sustainable development. In addition to the management rainfall and flooding which can produce bad drainage or stagger traffic and causing damage to public and private property.

## 12:00 **Managing Resources: The Role of the Engineer**

**Mr. Andrew Smith:  
Driver Group**

The Engineer has an important role to play in the effective management of





ever-decreasing resources and equally importantly, to identify and develop new and alternative resources. But how can engineering institutions help equip engineers with the knowledge and qualifications to play that role?

engineering know how as well as keep improving and acquire new competences. With this role comes responsibility to set up classification and recognition system that provide categorization as well as assist engineers to achieve this professional development.

## Session VI

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### Human Resources: The Engineers

1:20

#### **Engineers Classification in Oman**

**Prof. Ahmed Al-Naamany-Dean:  
Modern College of Business Science**

Many Engineering Societies are obliged to ensure that their members continue to keep themselves up to date with the

This presentation describes Oman engineers Classification System and the established Oman Society of Engineers chapters as well as training framework. It also details benefits to the engineer and the nation as well as to the engineering profession.

1:50

#### **Improvement of Quality Assurance System of Training Centers**

**Eng. Samih Alawi:  
Bahrain Society of Engineers**

The educational institutions and the



vocational training centers in Bahrain and also in the other Gulf Countries faces a problem that graduates from those institutions are not finding jobs in the market. The problem is generated because the graduates' knowledge and skills from the institution is not sufficient and suitable with the available job vacancies due to non-effectiveness of the educational and training systems in these institutions.

Therefore the government of Bahrain has taken the initiative to improve the quality of education and training by enacting the decree titled "National authority for quality and qualification for education and training" NAQQET framework which regulates the education and training of all schools, universities , and training centers.

Due to the issuance of this decree, Bahrain society of engineers training Center (BSETC) was faced with the challenge of implementing this NAQQET framework.

This paper will give general overview of

the NAQQET framework which has the principles of improving the vocational in the fields of: learner's achievements, the quality of the provision, how well the training programs meet the needs of the learners and stakeholders, how well the learners are supported, and the effectiveness of the leadership and management.

Then the paper will give details on how BSE training center has implemented the framework requirements. It will overview of the forms and procedures which need to be completed and verified before, during and after conducting the course. The presentation will also show samples of the developed documents such as the trainees, trainer, quality policy and operating procedures manuals. It will further give details on future areas for improvements, and other activities like training and raising awareness programs.





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