SuNEC 2011. A Sunny First Success

Mario Pagliaro, Giovanni Palmisano
Istituto per lo Studio dei, Materiali Nanostrutturati, CNR, Palermo, Italy

The first Sun New Energy Conference (SuNEC) took place in Santa Flavia, Sicily, 5-7 July 2011 in a splendid conference venue. Jointly organized by Palermo's University and CNR – namely by **Sicily's PV Research Pole** -- the meeting covered some of the **latest developments in the solar energy science** and **technology**, with eminent speakers including Bernard Kippelen, Vincenzo Balzani, Claudia Bettiol and Ralph Nuzzo.

University's of Palermo Professors **Giuseppe Alonzo** and **Fabrizio Micari** thanked the organizers for their work and along with the conference chairman **Vittorio Loddo** opened a meeting that attracted a mix of industrialists, academics and graduate students from some 10 different countries, including Norway, Turkey, the US and Saudi Arabia.

Ralph Nuzzo, "G. L. Clark" professor of chemistry and a professor of materials science at the University of Illinois at Urbana Champaign, gave a memorable on new printing-based approaches to high performance, low cost photovoltaic energy conversion systems. Using highlights taken from his Group recent work he illustrated some of most important advances in materials science for exploiting synergies within additive and physical means of patterning and fabrication. The nanochemistry-based technology developed by his team is currently being used by the US company *Semprius* to manufacture high performance concentrator photovoltaic modules that make solar power generation economically viable in sunny climates.

Internationally reknown photochemist **Vincenzo Balzani**, now emeritus professor at the University of Bologna, explained the scope of the energy challenge requiring phase-out of fossil fuels with their severe damage to climate, environment, and human health. The energy crisis, he insisted, is not only a tough challenge, but also an opportunity to become more concerned about the world in which we live and engage in effective change. He invoked more research devoted to improve energy conversion efficiencies and to develop means that can counter the two intrinsic defects of sunlight, low density and intermittency. Finally, he concluded that a most important achievement will be the production of powerful, clean fuel hydrogen directly from water and sunlight.

On July 20, Professor Balzani's and Dr Armaroli's paper "**Towards an electricity-powered world**" was the first conference paper published online by *Energy & Environmental Science*, the RSC Publishing journal and official publication of the conference, whose 9.45 Impact Factor places it as the #1 ranked journal of 181 journals in its ISI subject category.

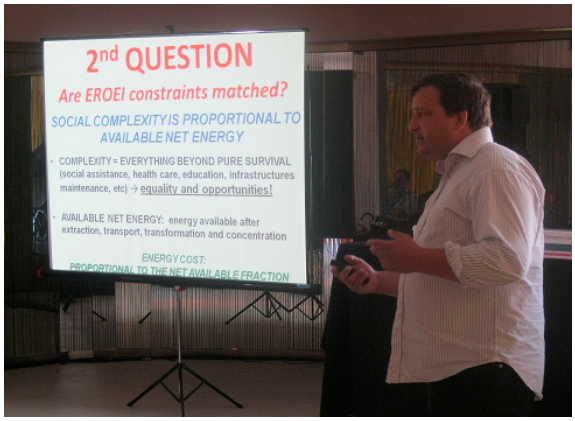
Bernard Kippelen, head of the Center for Organic Photonics and Electronics at the Georgia Institute of Technology, convincingly illustrated why organic photovoltaics will be one of the key clean energy technologies in the 21st century. Ten percent (10%) efficient plastic solar cells are very close, explained professor Kippelen, and will be reached within the next 18 months or so. However, the market for portable device is only 60 MW so that at 1$/W this will not be a significant market for this technology. Plastic solar cells instead will become ubiquitous and will especially be integrated in buildings and existing structures, including sails and tends. His talk reviewed the state-of-the-art and brightly discussed opportunities, with a final call for the development of green manufacturing methods based on renewable materials such as nanocellulose.

Giuseppe Calogero, from Messina's CNR, presented the hybrid solar cells using natural pigments developed his Lab in the last five years. Dye-sensitized solar cells (DSCs) assembled by using the bougainvillea flowers, red turnip and purple wild Sicilian prickly pear fruit juice extracts act as natural sensitizers of titania films. Overall solar energy conversion efficiencies approaching 2% are obtained with these natural products. The modules thereby produced, he concluded, will be used for instance in all those natural contexts where PV electricity is required with no environmental impact of the technology.

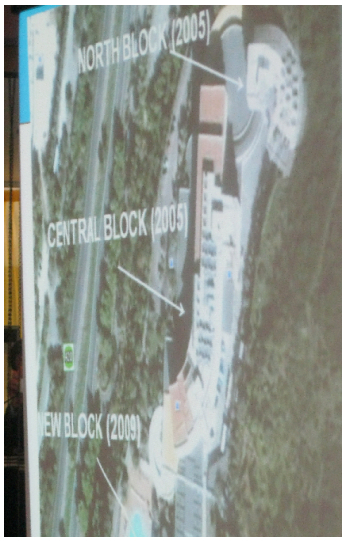
Aldo Di Carlo, head of CHOSE, University of Rome Tor Vergata, in his presentation explained how among all the organic and hybrid organic-inorganic solar cell technologies, dye solar cells (DSCs) have demonstrated the highest conversion efficiencies and a mature research and development plan. He then discussed the efforts made by Italy's consortium *Dyepower* to scale-up this technology from single, small area, cells to large area modules and panels aimed to building integration (BIPV) applications. Compared to traditional photovoltaics, DSCs indeed have several advantages, such as low dependence on angle of light, colors, transparency, which make DSC very appealing for BIPV.

Claudia Bettiol, director of *Bettiol & Partners*, explored the new perspectives opened by an integrated approach to energy efficiency and solar energy based on a new definition of energy efficiency involving man's habits and behaviour. This approach, highlighted Dr Bettiol, reduces the importance of technological performance and gives a new perspective and changes the meaning of planning. Trendy "Green Economy" (mainly technical based) evolves therefore into "Green Policy" (more human centric). And this policy will involve not only industrial strategy, research agenda, financial structures, administrative laws, urban planning, but also social aspects, entertainment industries and foreign affairs.

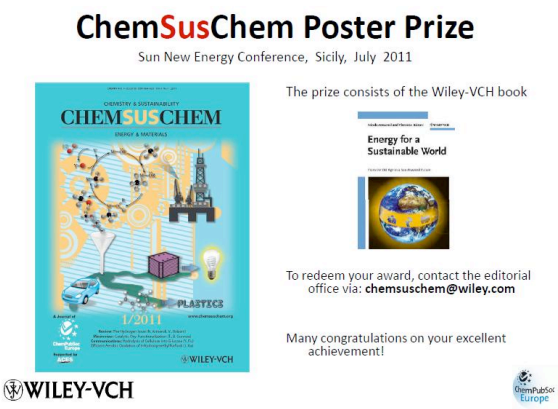
In his presentation **Francesco Meneguzzo**, from Firenze's CNR, showed how utility-scale PV plants in Italy, where recently installed PV power exceeded the 10 GW threshold, is actually a sustainable way towards low price electrictity. His analysis showed that at the current and projected prices of PV electrical plants, large ground-based PV installations can already offer their electricity into the Italian wholesale electric market at competitive prices. His arguments were based on a series of thoroughly presented empirical data on recent working days in Italy first presented at the meeting. The "grid parity" as well as the viability and sustainability of a solar PV-based economy, concluded Dr Meneguzzo, emerge as a present-day milestone along the way to a cheaper energy and environment-friendly economy.



Dr Francesco Liuzza, head of Sicily's operations of Accomandita Tecnologie Speciali Energia, described the impressive achievements of the costs saving and the technical solution for the combined thermosiphon solar thermal plant installed at the "Costa Verde" hotel in Cefalù, a touristic city in the northern coast of Sicily. Designed by Dr Liuzza, the plant is currently the largest natural circulation solar thermal system in Europe. Sicily is the warmest and sunniest Italian region. Yet, explained Dr Liuzza, production of sanitary hot water is mostly based on electric boilers as well as upon LPG and methane heaters. Beyond the environmental impact due to such obsolete production of heat at low temperature, this condition results in very high costs for both families and enterprises. Clearly, high external temperature and high solar radiation are perfect conditions for solar thermal applications. Further the touristic vocation of the island and the presence of numerous hotels offer the opportunity for wide application of the solar thermal technology to reduce internal costs, lower the environmental impact and create jobs and sound economics.

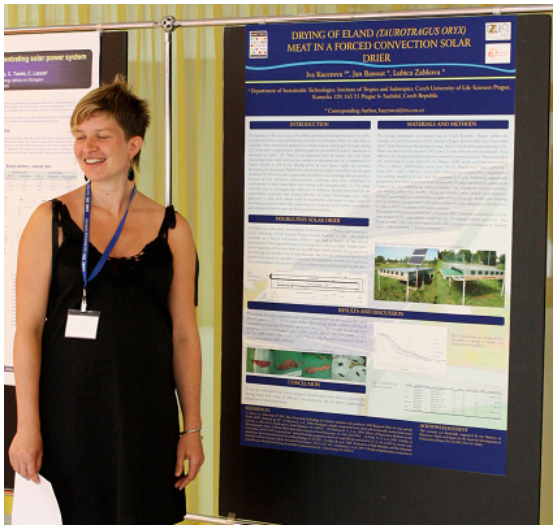


PhD student **Orlando Tari**, from Naples University "Federico II", described the preparation and characterization of ZnO sol-gel thin films deposited on glass substrates. Such low cost films afford results better or at least comparable to traditional ITO coatings widely employed by the electronic industry. The sol-gel process is simple, low energy intensive and fully controllable even in scaled-up conditions. Hence, he concluded, ZnO thin films will soon be employed in the PV and electronic industries.



Dr Giuseppe Cannella, currently a post-doc at Palermo's University, explained the properties of SnO_2:F/p-type hydrogenated amorphous silicon (a-Si:H) interface in thin film solar cells. He presented the results of the electrical characterization as well as of the simulation of the resulting heterojunction and concluded that the approach is highly promising towards the performance improvement of p-i-n diode a-Si:H thin film solar cells.

PhD student **Iva Kucerova**, from Prague's Czech University of Life Sciences, also presented a poster on solar essication of Eland meat. The technology uses a forced convection solar drier and results in terms of food preservation were excellent, which is very important for application in many developing countries where no cold chain is available.



Dr Ugur Deneb Menda, Yildiz Technical University, Turkey, presented a poster on the characterization of doped amorphous and crystalline silicon interface for heterojunction with intrinsic thin layer (HIT) solar cells, currently the most performing solar cells. The insertion of a thin amorphous layer between c-Si and doped a-Si:H films improves the cell performance by reducing interface state density, even if technical problems remain to be solved.

Tamara Passera, from ENI's Research Center for Non-Conventional Energies in Novara, Italy, presented a poster describing a possible heat transfer fluid consisting of a eutectic mixture of inorganic salts for use in concentrating solar power (CSP) or other high temperature processes.

Mr **Giuseppe Ferrante**, from PV solar company *Medielettra*, presented a poster on innovative BIPV solutions adopted to integrate PV power generation on the roofs of Sicily's towns and villages.

All posters were awarded the prizes offered by *ChemSusChem* namely the book *Energy for a Sustainable World* by Armaroli and Balzani fitting well with the theme of the conference. The prize inaugurates a tradition for a top interdisciplinary publication of

the publisher Wiley-VCH which emphasizes the importance of solar energy in its editorial policy.

Social Program

On the afternoon of July 6th, delegates relaxed on the boat decks and marvel at the sights of the Castle of Solanto, the Formica rocks and Aspra – part of Sicily's northern coast featuring a multitude of historical remnants and natural marvels, as well as at unknown corners of the coast.

On the evening of the same day a banquet dinner based on Sicilian cuisine and time-honoured recipes was served. The menu indeed included a number of Sicilian specialties matched with local wines.

SuNEC 2011 would not have been possible without the energy and commitment of our friends and co-workers **Rosaria Ciriminna**, **Marzia Sciortino** and **Piera Demma Carà**.

Conference delegate **Dr Ibraheem Al-Mofeez**, University of Dammam, Saudi Arabia submitted a report regarding the conference to Ministry of Higher Education as well as to the Ministry of Water and Electricity. "*I think* -- he wrote the conference chairmen -- *that this conference was an eye-opener to see Italy at the cutting edge of solar energy materials*".

Mario Pagliaro, chairman of the **2nd SuNEC** Conference, thanked the participants and invited them to the next meeting that will be held in Sicily on **September 4-6, 2012**. To register go right now to the conference website: www.solar-conference.eu