

MEDIA RELEASE

EMBARGO FOR 4 JULY, 5PM

S\$10 MIL AWARDED TO EIGHT RESEARCH TEAMS UNDER THE CLEAN ENERGY RESEARCH PROGRAMME

- *International panel of experts selected the eight research proposals out of 60 submissions in this inaugural call*
- *Selected projects span a wide range of Solar Technologies*

1 The first group of proposals that will be awarded grants totalling S\$10 million under the Clean Energy Research Programme (CERP) was announced by the Clean Energy Programme Office (CEPO) today.

2 The eight awarded proposals span a wide range of technologies in the solar energy field. This includes R&D in the various main classes of solar energy, including purification of solar-grade silicon used in conventional wafer-based solar cells, thin-film photovoltaics (PV), novel PV technologies such as dye-sensitised solar cells, as well as high-efficiency concentrator solar cells. There are also application-related research projects, namely Building Integrated Photovoltaics (BIPV) and distributed generation.

3 The international Project Evaluation Panel members were pleased with the high quality of the selected projects. Professor Andrew Blakers, one of the foreign PEP members and Director of the Australian Research Council Centre for Solar Energy Systems said, "I am enthusiastic about the eight projects that have made the cut. They demonstrate internationally competitive science from strong teams led by skilled researchers. All will contribute to the international effort to replace greenhouse-emitting energy sources with clean renewable energy."

4 CEPO's Executive Director, Mr Ko Kheng Hwa, who is also EDB's Managing Director, said, "We are happy to see the strong interest from both academia and industry in our inaugural call for proposals. This is a further boost to the strong growth momentum in our fledgling solar industry. This programme represents the government's commitment to support research in the Clean Energy sector and we look forward to supporting more bottom-up ideas from both the public and private sectors."

5 The Clean Energy Research Programme was launched by CEPO on 30 October 2007 to accelerate research and development efforts to help drive the growth of the Clean Energy industry in Singapore. This S\$50 million initiative supports both upstream and downstream commercially-relevant R&D

efforts through a competitive project funding approach. (See Annex 2 for more information on CERP)

6 The first CERP grant call closed on 31 January 2008 and received 60 proposals from Singapore-based researchers in local Institutes of Higher Learning as well as private sector companies.

7 The domain for the first call was specifically Solar Technologies. The proposals were evaluated through a first round of international peer review. Subsequently, selected research teams were invited to present to CEPO's Project Evaluation Panel (PEP) comprising eminent international and local members and the PEP recommended eight for funding. (See Annex 3 for a list of the PEP members)

8 The eight research proposals awarded funding are (in alphabetical order):

- Computational Tools for Optimal Planning and Scheduling of Distributed Renewable Energy Sources (National University of Singapore)
- Development of Flexible Dye Sensitized Solar Cells for Commercial Applications (NUS and Nanyang Technological University)
- Development of New Prototypes of High Performance Quantum Dots Excitonic Solar Cells (NUS)
- High Efficiency Multijunction III-V Solar Cell Technology for Terrestrial Photovoltaic Application (NTU)
- Innovative Processes for Low-cost Solar-grade Silicon Purification (Sinomem Technology Limited)
- Low Cost, Microcrystalline Silicon Thin-Film Solar Cells via Advanced Plasma Processing (NTU)
- Multifunctional Photovoltaic Facades with Integrated Innovative Thin-film and Selected Emerging PV Technologies for Energy Generation and Conservation (NUS)
- Novel High Efficiency Solid-State Self-sensitized Solar Cells (NTU)

9 CEPO plans to issue two grant calls every year and the next CERP call will open in August 2008.

Please see:

Annex 1 for quotes from CEPO, PEP and the recipients.

Annex 2 for more information on CERP.

Annex 3 for a list of CERP's PEP members

Annex 4 for brief write-ups on the 8 selected projects, the lead Principal Investigator and his research team.

For media queries, please contact: Ms Tjan Hui Shi

DID: 65-6832-6216 / Mobile: 65-9007-2162 / Email: hui_shi_tjan@edb.gov.sg

ANNEX 1

Quotes

2 Professor Andrew Blakers, one of the foreign PEP members Director of the Australian Research Council Centre for Solar Energy Systems said, "I am enthusiastic about the eight projects that have made the cut. They demonstrate internationally competitive science from strong teams led by skilled researchers. While some of the proposals are for longer term research, all of the projects show promise of generating commercial outcomes. All will contribute to the international effort to replace greenhouse-emitting energy sources with clean renewable energy. These grants will also be valuable in supporting the critical need to train researchers in this sector." (See Annex 3 for the list of PEP members)

3 Dr Yoon Soon Fatt, Professor at NTU's School of Electrical & Electronic Engineering, whose programme was selected to receive funding, said, "This inaugural call is an extremely timely activity to further boost Singapore's effort in securing its place on the world map for innovative solar technologies aimed at cost reduction and high efficiencies. Success in creating industry compatible solar cell technologies and intellectual property will help to nucleate home-grown companies as well as continue to anchor some of the world's most successful companies in Singapore."

4 Dr Stephan Wittkopf, Assistant Professor at NUS's department of architecture, whose programme was also selected to receive funding, said, "I am delighted to hear of CEPO's support for my proposal. PV modules are usually seen as generators of electricity. However with new and emerging technologies, PV modules can turn into design elements with no limitations on colors, shapes, transparencies, texture, rigidity etc. In addition, they can serve as shading elements and daylight modulators, reducing energy consumption in buildings. Research and development in niche areas such as Building Integrated Photovoltaics (BIPV) is critical to achieve the grander visions of architecturally-pleasing and carbon-neutral buildings that will be features of future eco-cities. This gives us at NUS' Department of Architecture an opportunity to play a central role in the region and worldwide."

ANNEX 2

Background Information on Clean Energy Research Programme (CERP)

CERP aims to kick start the R&D activities in Clean Energy in Singapore. R&D proposals will be received through calls for proposals in specific themes identified by CEPO (top-down approach) or in open-theme calls (bottom-up approach). This programme will be instrumental in helping to develop the technological capabilities needed to accelerate the growth of the Clean Energy industry in Singapore.

Under this programme, Singapore-based local and foreign R&D organisations, including institutes of higher learning (IHLs), public sector agencies, private sector companies and not-for-profit research laboratories are encouraged to bid competitively for the research funding.

Eligibility and Funding Support

This call is open to Institutes of Higher Learning (IHLs), public sector agencies, not-for-profit organisations and private sector companies based in Singapore. Collaborations among the above organisations are eligible too. IHLs, public sector agencies and not-for-profit organisations will qualify for up to 100% funding support of approved direct qualifying costs of a project. Private sector companies will qualify for up to 70% of the approved direct qualifying costs of a project. Only IHLs and not-for-profit entities would be allowed support for indirect costs. These include up to 20% of qualifying costs for overhead costs and an additional support of up to 10% to support IP protection and commercialisation activities.

Evaluation Processes

Proposals will be sent to international peer reviewers who are recognized experts in Clean Energy. Top ranked proposals will then be submitted to CEPO's Project Evaluation Panel (PEP) comprising eminent international and local members. The PEP will then evaluate and recommend the proposals for CEPO's consideration for funding support.

Applications

Calls for proposal are publicized on NRF's RITA system. Interested applicants may find out more about the CERP calls and submit their applications for the next call through this system

For more information, please visit <https://rita.nrf.gov.sg/cerp>.

ANNEX 3

Below is a list of the Clean Energy Research Programme's Project Evaluation Panel Members:

Members	
1.	A/Prof Ho Hiang Kwee (Chairman) Programme Director (Energy Technology R&D), Science & Engineering Research Council (SERC), A*STAR, Singapore, and Director of Energy Systems Laboratory and Associate Professor, School of Mechanical & Aerospace Engineering, Nanyang Technological University (NTU), Singapore
2.	Prof Andrew William Blakers Director of the Australian Research Council Centre for Solar Energy Systems, Foundation Director of the Centre of Sustainable Energy Systems, Faculty of Engineering and Information Technology, Australian National University (ANU), Australia
3.	Prof Christophe Ballif Full Professor, Head of the Chair, Photovoltaics and Thin Film Electronics Laboratory, Institut de Microtechnique (IMT), Université of Neuchâtel, Switzerland
4.	Prof Masafumi Yamaguchi Director, Super High-Efficiency , PV Research Center Toyota Technological Institute, Japan
5.	Ms. Marjorie L. Tatro Director of Fuel and Water Systems, Sandia National Laboratories, USA
6.	Mr. Goh Chee Kiong Deputy Director, Environment & Clean Energy, and concurrently Programme Manager for Urban Solutions, Singapore Economic Development Board (EDB)
7.	Mr. Tan Tian Chong Director, Technology Development Division, Building and Construction Authority (BCA), Singapore, and Deputy Chairman, Building Construction Standards Committee, and President, Singapore Structural Steel
8.	Dr. Johnny Wong Liang Heng Deputy Director (Building Research), Housing Development Board (HDB), Singapore

9.	Mr. Ananda Ram Bhaskar Head (Energy Conservation & Environmental Technology Unit), National Environment Agency (NEA), Singapore
----	---



ANNEX 4

1) Computational Tools for Optimal Planning and Scheduling of Distributed Renewable Energy Sources

The emerging renewable energy sources are guiding the way toward addressing growing energy and environmental concerns, and leading to more efficient and clean energy utilization. This project will explore the operation and reliability issues associated with system integration of solar power generation. Due to high dependency on the weather, the impact of solar energy in terms of cost, benefit, and reliability should be thoroughly analyzed before system integration in order to ensure secure and economic operations of power systems. The availability of this type of source is obviously correlated with the duration and intensity of sunlight in a day. The prediction of solar power generating capacity is a challenging issue. This project will develop computational tools to investigate the complex relationship between the solar power generation capability and load demand with weather variables. A study of this relationship between the generating capacity and the demand will give an insight on how to effectively and economically utilize the available energy sources for scheduling and planning purposes. The project will also develop optimization tools for scheduling and planning problems with the objective to maximize system security and reliability with least cost in the presence of uncertainties in solar power generating capacity and load demand. It is expected that novel computational-intelligence based algorithms and mathematical programming techniques will be developed in this project for global optimization with multiple objectives and constraints.



Principal Investigator

Dr Dipti Srinivasan is an Associate Professor in the Department of Electrical & Computer Engineering, National University of Singapore. Her main areas of interest are neural networks, evolutionary computation, intelligent multi-agent systems, and application of computational intelligence techniques to engineering optimization, planning and control problems in intelligent transportation systems and power systems. Prof Dipti Srinivasan is a senior member of IEEE and a member of IES, Singapore.

Co- Principal Investigator:

- Prof Panida Jirutitijaroen, NUS

Collaborators:

- Dr. Li Qi, Florida State University
- Prof Chanan Singh, A*STAR

2) Development of Flexible Dye Sensitized Solar Cells for Commercial Applications

Today, we realize that we are not only running out of energy, but also lacking experience in developing inexpensive energy devices such as dye sensitized solar cells (DSSCs). Through this three-year joint program between NUS (department of chemical and biomolecular engineering) and NTU (school of civil and environmental engineering), we hope the discovery of new inexpensive flexible TiO₂ nanofiber/tube membrane solar cell technology will provide great opportunities for the sustainable energy supply and the development of our economy. As we know, low cost fabrication of DSSCs and its device stability are currently two main technical issues that hamper the commercialization of the DSSCs. The proposed joint project aims to solve these technical issues. We expect that we will be able to produce new cost effective DSSCs and to train the next generation experts through the three-year joint program.

Principal Investigators:



Dr. Liu Bin is an Assistant Professor at the Department of Chemistry and Biomolecular Engineering, National University of Singapore. She won the NUS Young Investigator Award 2006. She specializes in biomaterials, conducting polymers, chemosensors and biosensors. Her work focuses on the synthesis and use of conjugated water-soluble polymers with potential applications in optoelectronic devices and as biosensors.



Dr Darren Sun is an Associate Professor at Division of Environmental & Water Resources Engineering, Nanyang Technological University. He has 15 years experience in the development of novel technologies for the environmental remediation, in particular industrial solid waste treatment and reuse with encapsulation/stabilization, recovery and separation technologies, and wastewater treatment with biological, chemical and physical technologies. He is a member of International Water Quality Association. He edited or co-edited a few conference proceedings, Journals, and authored or co-authored more than 100 scientific publications. His research interests include multifunctional TiO₂ nanofiber/tube membrane, membrane technology for water and waste water treatment, photocatalytic oxidation technology for water purification, membrane bioreactor and industrial & hazardous waste treatment and management.

Collaborators:

- Dr. Tim White, NTU
- Prof James Leckie, Stanford University
- Dr. Jiang Changyun, Institute of Microelectronics of Singapore (IME)

3) Development of New Prototypes of High Performance Quantum Dots Excitonic Solar Cells

In recent years, solar cells that mimic the natural solar energy conversion process, known as excitonic solar cells (ESCs) cells are getting increased attention due to the possibilities of cost-effectiveness and ease of fabrication compared to the crystalline silicon and multijunction solar cells. Most organic-based solar cells, including dye-sensitized solar cells, DSSCs, fall into the category of ESCs. In these cells, excitons are generated upon light absorption. The organic or organometallic dyes used in conventional DSSC are capable of generating only one electron and hole from single photon absorption. However, quantum dots, which are inorganic semiconductors of size less than a fundamental length scale called exciton Bohr radius, possess an ability to produce more than one electron and hole carriers by absorbing single photon of suitable energy. If this property could be exploited to build a solar cell, then more fraction of the solar energy could be converted into electrical energy. Present research is to develop prototypes of such solar cells by comprehensively investigating multicarrier generation, charge injection, and transport when quantum dots are judiciously linked to suitable photoelectrode materials and architectures. This project aims to develop new quantum dot based excitonic solar cells and will also produce a data base of material properties and compatibilities when a certain quantum dot is considered for photovoltaic applications and will be serve as excellent reference for academia and industries.



Principal Investigator:

Prof Seeram Ramakrishna is Vice-President (Research Strategy) at the National University of Singapore. He is a Professor of Mechanical Engineering as well as Bioengineering at NUS. He serves on the boards of public organisations and is a member of several committees including Engineering Accreditation Board, Institution of Engineers Singapore (IES); National Technology Award (NTA) Committee, Agency for Science, Technology and Research (A*STAR); Manufacturing Excellence Award (MAXA) Committee, EDB; National Science Scholar Selection Committee, A*STAR; National Committee for Promotion of Engineering, Ministry of Trade & Industry; and Joint Academic Committee of Singapore-MIT Alliance. The ISI Essential Science Indicators (ESI) places him among the leading 150 materials scientists in the world. He received several awards and honors including Lee Kuan Yew Fellowship, NUS Outstanding University Researcher Award, Institution of Engineers Singapore (IES) Prestigious Engineering Achievement Award, and ASEAN Outstanding Engineering Award.

Co- Principal Investigators:

- Dr Stefan Adam, Dr. Palani Balaya, Dr. Jose Ranjan, Dr. Wang Qing, NUS
- Prof Michael Graetzel, EPFL
- Dr. Han Ming Yong, A*STAR

4) High Efficiency Multijunction III-V Solar Cell Technology for Terrestrial Photovoltaic Application

This project aims to integrate advanced III-V photovoltaic with silicon-based infrastructure to produce a new technology that will achieve solar cells with higher cell efficiencies and lower manufacturing costs. Unlike silicon, which is used widely in electronic chips for consumer electronics, III-V (pronounced as three-five) compound semiconductors have special properties that make them unique and highly suitable for energy conversion devices that absorb or emit light, such as solar cells and lasers. Compared to current technology, III-V compound semiconductors have the unique ability to increase the power output of modern day solar cells by more than 4 times. High- efficiency concentrator multijunction III-V solar cells are currently an important area of clean energy development, whereby solar radiation is focused onto a semiconductor chip consisting of three semiconductor junctions. Each of these junctions serves to convert a different portion of the solar energy spectrum. Currently, the highest achievable laboratory-scale energy-conversion efficiency is 40.7%. If the solar industry can successfully increase the efficiency towards the 45-50% range, megawatt-capacity clean energy generation can become economical enough to be a significant part of the world energy mix. Furthermore, using III-V compound semiconductors for solar cells will result in smaller devices that can be mass produced in local wafer fabrications plants. By leveraging on the existing semiconductor expertise and infrastructure in Singapore to create a new integrated III-V/Si photovoltaic industry, the proposed commercialisation path is capital-efficient, as the industry does not need to be built from scratch.



Principal Investigator:

Prof Yoon Soon Fatt is a Full Professor of School of Electrical & Electronic Engineering, Division of Microelectronics, Nanyang Technological University (NTU). In NTU, he directs the Compound Semiconductor & Quantum Information (CSQI) Group which presently comprises more than 20 research students and research staff. He has published and presented more than 500 papers in international peer-reviewed journals and international conferences in the compound semiconductor, thin films and solid state photonics and RF device areas.. As Fellow of two programs (Advanced Materials for Micro- and Nano-systems and Manufacturing Systems Technology) under the Singapore-MIT Alliance Program, he has extensive collaborations with MIT, as well as a number of key institutions in US, Japan and Europe (under the European Commission Research Framework).

Co- Principal Investigator:

- Prof Eugene A. Fitzgerald, MIT

Collaborators:

- Prof James Harris, Stanford University
- Dr. Desmond Lim, Dr. Tim White, Prof Zhang Dao Hua, NTU
- Prof Steven A. Ringel, The Ohio State University

5) Innovative processes for low cost solar grade Silicon (Si) purification

Targeted as an commercially effective solution to cope with high production cost and severe shortage of solar grade Si wafers, this project, proposed from the Sinomem Technology Limited, Singapore (SINOMEM) and the National University of Singapore (NUS), represents the first systematic approach to combine novel membrane technologies with acid leaching, advanced plasma and laser processing to purify polycrystalline Si materials from 99% to 99.9999% solar grade Si powders. The growing photovoltaic market is primarily based on the crystalline silicon technology and is limited by the availability of a proper silicon feedstock. "Solar grade" silicon (SoG-Si) serves as the base material for the crystalline silicon sheets used for the production of solar cells. The two key technical challenges for solar cell development are energy conversion efficiency and manufacturing cost, which limit the competitiveness of solar generated electricity against other sources of electricity. Fabrication of low cost primary materials of SOG poly-silicon is one of the key factors in controlling the solar generated electricity cost. The innovative purification process explored in this project will possess the advantages of low manufacturing cost, energy saving and zero-acid discharge with the 4R nature of recycle, reduce, recovery and reuse to cater for the next-generation eco-friendly manufacturing.



Principal Investigator:

Dr Lan Wei Guang is the Founder and Managing Director of Sinomem Technology Limited. Established in 1996, Sinomem is a leading integrated membrane technology company with its headquarters in Singapore and a core subsidiary in China. He is also an adjunct associate Professor in Department of Chemistry, National University of Singapore. In 2003, Dr Lan won the Young Chinese Entrepreneur Award organized by Yazhou Zhou Kan. In June 2004, he was elected as Vice Secretary-General of the China Membrane Industry Association. In 2005, he won the Outstanding Entrepreneurship Award awarded by the State Oversea Chinese Affairs Office of PRC, the "Golden-Bridge" Award awarded by the Chinese Technological Market Association and the Outstanding Science Alumni Award awarded by the National University of Singapore.

Co- Principal Investigators:

- Prof Hong Minghui, Prof Li Sam, NUS
- Prof Pu Weidong, Sinomem Technology Limited

Collaborators:

- Mr. Hans Jorg Heckmann, Sinomem Technology Limited
- Mr. Wang Zhi Ping, Siping Goldstar Nanomaterials & Systems Limited
- Prof Zheng Chunmiao, University of Alabama
- Prof Zhou Weibiao, NUS

6) Low Cost, Microcrystalline Silicon Thin-Film Solar Cells via Advanced Plasma Processing

This research project aims to develop high-efficiency, low-cost, thin-film solar cells in which solar light energy is converted into electricity. The solar cells will be made of microcrystalline silicon-based thin films on large area and low-cost substrates (e.g. glass, flexible metal sheets) using proprietary advanced low-temperature, high density plasma sources and processes developed at the Plasma Sources and Applications Centre, NIE/NTU (see attached photograph). The new fabrication processes will feature a high level of deterministic control over production of plasma species and their interaction with solid surfaces hence will overcome a major limitation of existing silicon wafer based technologies by substantially reducing the amount of silicon material used and dramatically reducing the manufacturing costs. Using a novel approach, the team aims to significantly improve the quality and performance of photovoltaic materials and scale-up thin film solar cells, reduce the process cost, improve stability and eventually increase the energy conversion efficiency of solar cells beyond the existing commercial standards. As a result of this project, thin film solar cell will be able to generate much cheaper green power, and at the same time will exhibit excellent long-term stability in operation under extreme sunlight exposure compared to the existing silicon wafer-based photovoltaic modules.



Principal Investigator:

Prof Shuyan XU is a Professor at the Plasma Sources and Application Centre, NSSE, National Institute of Education. Prof. Xu's research interests lies in the area of high density inductively coupled plasma sources, integrated plasma facilities for industrial applications; thin film Si/SiC photovoltaic materials and solar cells; plasma nanoscience, assembly of nanomaterials, quantum dots, wires, superlattices and biomedical materials; materials synthesis and surface processing, modification and implantation and modelling, simulation and diagnostics of reactive plasma and self-organization processes. He is the key driver of the Division of Plasma Physics/ Association of Asia-Pacific Physical Society and a guest lecturer of the DPP Graduate School on Plasma Physics.

Collaborators:

- Prof Armin Arbele, Solar Research Institute of Singapore
- Mr. Cheng Qijin, NIE
- Prof Kostya Ostrikov, University of Sydney
- Dr. Rajdeep Singh Rawat, NIE
- Dr. Sun Changqing, NTU

7) Multifunctional Photovoltaic Facades with integrated innovative thin-film and selected emerging PV technologies for energy generation and conservation

Building Integrated Photovoltaics (BIPV) is often viewed as rooftop installations following the single objective of producing electricity to feed into the grid. BIPV should encompass PV technology as part of the building skin fulfilling energy related tasks as well as performing thermal, visual, aesthetic, branding, weatherproofing etc. functions. This proposal puts forth BIPV as a strategy to produce AND conserve energy in buildings. This project will leverage on a practical demonstration site to evaluate cost effective or innovative BIPV elements (such as semitransparent PV windows or skylights, PV shades, ventilated facades and curtain walls) and develop a planning tool that will help architects and urban planners to consider BIPV in the early concept design by providing critical information on energy production and conservation. The project will also result in the development of core databases with properties of PV panels, BIPV projects and solar radiation in the local conditions. By taking a lead in BIPV research in the tropical belt and Southeast Asia, Singapore will be in a good position to play an important role in the building of the world's eco-cities and lead international programmes in this space.



Principal Investigator:

Dr Stephen Wittkopf is Assistant Professor in the Department of Architecture, National University of Singapore. He is member of the IDM network contributing aspects on Architectural Design and Technology Transfer. His research interests include application review and developments to support generation, visualization, simulation and communication of design, solar architecture, sustainable architecture, design methods and assessment tools. His research focus is in building integrated photovoltaic, advanced daylighting and computational simulation and visualization. From 1997-1999 he joined ERCO and developed virtual luminaires which are distributed with 3D Studio Max and have been used by many lighting designers.

Collaborators:

- Prof Rolf Cornel Buschmann, EnEd - International Education Center for Energy Solutions
- Mr. Benjamin Fillies, Solar Info Center
- Ms. Alice Goh , Ms. Yvonne Soh, BCA
- Dr. Ingo Bert Hagemann, Architekturbuero Hagemann
- Prof Karel Kabele, Czech Technical University in Prague
- Mr. Tilmann E. Kuhn, Fraunhofer ISE
- Dr. Stefan Nowak, NET Nowak Energy & Technology
- Prof Chou Siaw Kiang , Prof Deo Prasad, NUS
- Mr. Tjerk Reijenga, BEAR Architecten - KOW X
- Prof Jean-louis Scartezzini, Mr. Christian Roecker, EPFL
- Mr. Stephen Selkowitz, LBNL
- Dr. Mark Snow, UNSW
- Prof Marija Todorovic, University of Belgrade & VEA-INVI Ltd

8) Novel High Efficiency Solid-State Self-sensitized Solar Cells (S5C)

Dye-sensitized solar cells (DSC) are a relatively new class of low-cost solar cells. These cells are attractive candidates because of their simple structure, low cost base and relatively less complex manufacturing process. The major drawbacks for the DSSCs are the use of liquid electrolyte that limits the service life of the solar cell under prolonged sunshine, and the use of the organic Ru-based dye sensitizer suffers long term stability. Researchers worldwide are looking for a solid state variant of the DSSCs without the use of liquid electrolyte and organic dye. In DSSCs, effective absorption of the solar visible light and generation of the charges as well as the effective collection of the generated charges on the two electrodes are the basic requirement for efficient solar energy conversion. The aim of this project is to develop and construct a simple inorganic solid state solar cell using the alternative novel materials we have developed. The novel solar cell will have effective absorption of visible sunlight and electrical conversion without the use of liquid electrolyte and organic dyes. It would be a strong contender as next generation solar cell if the conversion efficiency and reliability can be enhanced at relatively lower manufacturing costs. Our ultimate goal is to fabricate these solid state solar cells on flexible substrates such as sheet metals, plastics, clothes and canvas etc. which allows the transport and installation of the solar cell to be much easier.



Principal Investigator:

Prof Tan Ooi Kiang is a Professor and Associate Chair (Curriculum & Graduate Studies) of School of Electrical & Electronic Engineering, Nanyang Technological University. Dr Tan has been actively involved in the Sensors, Actuators, and Smart Materials as well as the Nanoelectronics and Silicon Technology research groups in the Microelectronics Center, School of EEE. His research focus is in the area of microelectronics and nanoelectronics materials and devices design for electronics, bio-medical, functional sensor and actuator applications. His research interests include functional electronics materials, devices, and applications; Chemically-activated nano-structured metal oxide semiconductor and ferroelectrics materials for chemical and bio-sensor devices. Dr Tan has been appointed as a member of International Steering Committee for the East Asian Conference on Chemical Sensors since 2001. He is currently the General Chair for the 7th East Asian Conference on Chemical Sensors (EACCS) to be held in Singapore in December 2007. He is a Senior Member of the Institute of Electrical & Electronic Engineers (USA).

Co-Principal Investigator:

- Prof Tse Man Siu, NTU

About Clean Energy Programme Office (CEPO)

The Clean Energy Programme Office (CEPO) is Singapore's key inter-agency workgroup responsible for planning and executing strategies to develop Singapore into a Global Clean Energy Hub where clean energy products and solutions are developed here for the global market.

Set up in April 2007, CEPO leverages upon the strengths of various government agencies - the Economic Development Board (EDB), Building & Construction Authority (BCA), Agency for Science, Technology and Research (A*Star), Energy Market Authority (EMA), National Environment Agency (NEA), International Enterprise Singapore (IE Singapore) and Ministry of Trade and Industry (MTI) for a comprehensive approach to develop the clean energy industry.

Through the various agencies, CEPO grows and nurtures local and foreign Clean Energy companies through comprehensive cluster development, targeted internationalisation efforts, fostering of world-class research and technology development, and long-term manpower planning.

About the Singapore Economic Development Board

The Economic Development Board (EDB) is the lead government agency responsible for planning and executing economic strategies to enhance Singapore's position as a global hub for business and investment. We are the one-stop agency that facilitates and supports local and foreign investors in both the manufacturing and services sectors as they seek more value-creating operations, higher sustainable returns and new business opportunities.

Singapore commands global leadership positions in many areas. EDB is expanding and extending existing industry clusters, as well as exploring new growth areas to create good jobs and secure Singapore's future competitiveness. Our emphasis is on capital-intensive, knowledge-intensive and innovation-intensive activities. EDB is constantly identifying new business areas to develop both in terms of new technologies as well as new consumer demands, such as our 'clean and green' focus - environmental technologies, urban solutions and clean energy, lifestyle, healthcare and wellness. EDB is also expanding our geographical reach, such as Middle East, in addition to North America, Europe, Japan, China, India and ASEAN.

For more information on how EDB can help in your business and investment, please visit www.sedb.com

For media queries, please contact: Ms Tjan Hui Shi

DID: 65-6832-6216 / Mobile: 65-9007-2162 / Email: hui_shi_tjan@edb.gov.sg