

## **4. Competency-Building**

4.1. To facilitate Singapore's efforts to mitigate CO<sub>2</sub> emissions and adapt to climate change in an environmentally sustainable and cost-effective way, there is a need to build up a broad range of competencies together with our private sector, most notably our industries and research community, in technology and expertise.

### **CO<sub>2</sub> Mitigation Technology**

4.2. Research into clean and renewable energy will decrease our reliance on carbon-intensive fossil fuels. Developing energy-efficient technology will reduce the impact of our growing energy needs. The objective of our research is to improve the current state of technology, and bring down production costs to a level that would make large-scale adoption commercially viable.

#### Research and Development

4.3. Research in energy and climate-related activities are already being carried out by several research institutions in Singapore. For example, A\*STAR's Institute of Materials Research and Engineering, NUS and NTU are looking into novel materials for solar cells. Nanyang Polytechnic and Temasek Polytechnic have set up fuel cell R&D programmes. Temasek Polytechnic further plans to invest over S\$5 million to establish a Fuel Cell Application Centre, to engage start-ups in collaborative R&D.

4.4. In the private sector, the world's top wind technology company, Vestas is setting up a global wind R&D centre in Singapore. Rolls Royce is working with various research organisations in Singapore to develop stationary fuel cells. In October 2007, Renewable Energy Corporation (REC) from Norway announced an investment of about Euro3 billion (S\$6.3 billion) to build an integrated solar wafer, cell and module manufacturing facility in Singapore. Slated to be the largest solar manufacturing complex when completed, REC is expected to also undertake R&D in Singapore related to manufacturing automation and improvement, as well as solar cells.

4.5. Government is also taking an active role in driving R&D investment. In March 2007, the Research, Innovation and Enterprise Council, or RIEC, chaired by our Prime Minister, endorsed Clean Energy as a key growth area for Singapore with the target of generating S\$1.7 billion in value-added by 2015. The Economic Development Board (EDB) thereafter set up the inter-agency Clean Energy Programme Office (CEPO)<sup>1</sup> to grow the Clean Energy industry in Singapore by focusing on cluster development, technology

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<sup>1</sup> CEPO is led by EDB and comprises the following agencies: MTI, A\*STAR, BCA, EMA, IE Singapore and NEA.

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development and internationalisation, with an emphasis on solar energy. In the area of energy efficiency, NEA is working with relevant government agencies, academics and industry to identify suitable areas and technologies for research to support Singapore's energy efficiency efforts.

4.6. Key government initiatives on energy and climate-related research are given below.

### *National Research Foundation*

4.7. The National Research Foundation has set aside \$170m for research into clean energy to boost the development of the local Clean Energy industry over the next five years, focusing on research and manpower. Through this funding, CEPO has launched a S\$50 million competitive funding initiative known as the Clean Energy Research Programme (CERP) as well as the S\$25 million Clean Energy Scholarships.

### *Energy Technology R&D Programme*

4.8. To coordinate and enhance existing R&D efforts in clean energy technologies, A\*STAR established an Energy Technology R&D Programme. This programme will act as the focal point to coordinate, integrate and expand our efforts and capabilities in clean energy, especially in the areas of fuel cells, alternative fuels such as biofuels and hydrogen, as well as solar PV technologies. The programme will also identify and develop research focus relevant to Singapore. For example, as energy storage is an important component in the harnessing of renewable energy, A\*STAR is starting a new research focus into "intelligent distributed energy systems". In addition, the programme aims to develop the necessary talent and manpower for R&D in the energy sector and to develop Singapore as a vibrant centre for energy research.

### *MND Research Fund for the Built Environment*

4.9. In 2007, MND set aside \$50 million over the next five years for a new "MND Research Fund for the Built Environment". The MND Research Fund is to intensify R&D efforts in green building technologies and energy efficiency.

## Test-Bedding

### *Innovation for Environmental Sustainability Fund*

4.10. To encourage test-bedding of new technologies, NEA set up a S\$20 million Innovation for Environmental Sustainability (IES) Fund in 2001. The IES fund provides financial grants for companies to test-bed innovative technologies, which would contribute to environmental sustainability. For instance, NEA funded S\$1 million through the IES Fund to test-bed building-integrated photovoltaics (BIPV), an innovative PV technology in which solar PV cells are integrated into the façade of buildings, at the Biopolis. The IES

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Fund also provided funding support for Pfizer Asia Pacific Pte Ltd and Schering-Plough Ltd to build a 5 MW and a 9.2 MW trigeneration facility respectively. These facilities are expected to help Pfizer and Schering-Plough reduce their CO<sub>2</sub> emissions by 17% and by 24% yearly.

### *Clean Energy Research & Test-bedding Programme*

4.11. In August 2007, a S\$17 million Clean Energy Research & Test-bedding Programme was also launched by CEPO. Under this programme, the facilities and buildings in Singapore can be used as a “field laboratory” for clean energy technologies to be tested and integrated, before commercialisation. The lead R&D organisations are Singapore Polytechnic and the National University of Singapore. The initial batch of government agencies providing infrastructure for test-bedding include PUB’s Marina Barrage, National Parks’ Gardens by the Bay and Singapore Polytechnic’s campus, while BCA’s zero-energy building and HDB’s eco-precinct will be the test-bedding sites in the second phase of CERT. The goals of the test-bedding include examining the prospects of large-scale renewable energy adoption in Singapore, particularly in solar energy.

### *Market Development Fund*

4.12. EMA also established a S\$5 million Market Development Fund to facilitate test-bedding of non-traditional generation technologies that have significant value in the electricity market and other ideas/technologies that have development potential in the electricity market.

### *Singapore Initiative on New Energy Technology*

4.13. Going forward, to provide a platform for the development and test-bedding of clean energy technologies and sustainable energy solutions, A\*STAR will establish the Singapore Initiative on New Energy Technology (SINERGY) Centre. The SINERGY Centre will be a test-bedding facility and a platform for R&D collaboration and development of thought leadership in alternative energy and distributed generation. It will work with independently-funded research groups from both the public and private sectors. Through these collaborations, the Centre will look to develop expertise in systems integration and evaluation of technologies, with the eventual goal of providing this expertise in the form of consultancy services to address issues such as energy efficiency, fuel as well as grid management.

## **Energy Management and Carbon Expertise**

4.14. With the nation-wide drive to improve energy efficiency and the worldwide move to reduce CO<sub>2</sub> emissions, there will be a demand for energy management capabilities and services and carbon consultancy services. The establishment of relevant training courses, accreditation schemes and institutes will help to build up a pool of such skills and expertise in Singapore.

### Energy Management

4.15. The Singapore Certified Energy Manager (SCEM) programme, jointly developed by NEA, ESU, EDB, EMA and BCA in consultation with industry, is the first of its kind to be launched in the region. The SCEM programme establishes a Training Curriculum and a National Certification System for energy engineers and managers in Singapore.

4.16. The Energy Sustainability Unit of NUS currently administers an energy service company (ESCO) Accreditation Scheme. Accrediting ESCOs enhances the professionalism and quality of services offered by ESCOs. This, in turn, will enhance confidence in the energy services sector and help to promote the growth of the industry.

4.17. Moreover, to facilitate the sharing of knowledge, expertise and best practices in energy efficiency and carbon markets, NEA together with other agencies such as BCA will hold energy efficiency seminars and workshops that bring together local and overseas experts and various stakeholders.

### Energy Policy

4.18. As energy policy is multi-faceted and complex, energy policy research will help to provide thought leadership and analysis in the complex issues of energy and climate change. The Government therefore launched the Energy Studies Institute (ESI) under the NUS on 12 November 2007. ESI will examine the economic, environmental and geopolitical implications of energy use and will be a focal research node for energy policy, including its relationship with the environment and climate change, in Singapore.

### Clean Development Mechanism and Carbon Trading

4.19. Under the Kyoto Protocol, a series of market mechanisms have been set up to allow countries to achieve cost-effective emission reductions. The Clean Development Mechanism (CDM) is a market mechanism that allows an Annex I country to invest in emissions reduction projects in a non-Annex I country and to count the emission reductions (known as Certified Emission Reductions or CERs) towards their KP emission targets. In exchange, the non-Annex I country can benefit not just from the revenue from the sale of CERs, but also from foreign investments with potential technology transfer.

4.20. Carbon trading refers to a system in which parties buy and sell carbon credits. It has been established in Europe and the US. Australia and New Zealand have also announced plans to set up carbon trading systems.

4.21. Singapore acceded to the Kyoto Protocol in April 2006. As a non-Annex I Party to the Kyoto Protocol, we can host CDM projects. NEA is the Designated National Authority on CDM, which ensures that CDM projects

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support sustainable development in Singapore. Potential CDM projects in Singapore include waste-to-energy projects and energy efficiency projects.

4.22. Asia alone represents about 70% of global CDM potential for emissions reduction, and Singapore is keen to grow a carbon services sector to service the Asian market. There is interest from the private sector in different parts of the carbon value chain to start operations in Singapore to support the development of CDM projects in the region. For example, project origination teams from companies like Deutsche Bank, the Development Bank of Japan, and Morgan Stanley have also located themselves in Singapore. Carbon advisories like Environmental Resource Management Services and EcoSecurities have gathered here as well.

4.23. To assist companies in taking advantage of the numerous CDM projects in Asia that generate carbon credits, International Enterprise Singapore has designated carbon credits as a qualifying product under the Global Trader Programme (GTP). This would allow qualifying companies to enjoy a tax concession on qualifying income from emissions trade. This incentive aims to build up a critical mass of companies along the carbon value chain, anchoring their emissions trading in Singapore.

4.24. To foster interest in CDM, carbon trading, and related opportunities in Singapore, NEA and IE Singapore have organised meetings, seminars and workshops with industries that have an interest in CDM projects. The private sector is playing a role too. For example, the International Emissions Trading Association and Koelnmesse organised Carbon Forum Asia 2007 in Singapore, which is a major regional conference and trade fair on carbon trading and carbon abatement technologies. This forum, which managed to attract over 1000 participants from 46 countries, was hosted by the Sustainable Energy Association of Singapore and supported by various government agencies including EDB, IE Singapore and NEA.

4.25. NEA will continue to raise awareness amongst companies to facilitate CDM projects in Singapore<sup>2</sup>. To date, NEA has issued a Letter of Approval to Bee Joo Industries Pte Ltd for its waste heat recovery project, a first step in its application for Certified Emissions Reductions (CERs) from the United Nations CDM Executive Board. In another first for our power industry, PowerSeraya Ltd plans to apply for CERs for their impending replacement of three oil-fired steam units with more efficient cogeneration combined cycle units.

4.26. In 2006, the Renewable Energy Exchange Capital Asia (ReEx Capital Asia) was also set up in Singapore to help bring together investors looking for projects in renewable energy and project developers seeking funding. The Renewable Energy and Energy Efficiency Partnership and the Development Finance arm of the German Government have committed to

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<sup>2</sup> Companies who are interested in participating in CDM projects can refer to the NEA website at [www.nea.gov.sg/](http://www.nea.gov.sg/)

provide funding support for the initial establishment and operation of the Exchange.

## **Vulnerability Assessment and Adaptation Technology and Expertise**

4.27. Research into vulnerability assessments and adaptation technologies will help us address our vulnerabilities to climate change more effectively.

4.28. In February 2007, NUS set up the Environmental Research Institute to look into climate change and other environmental issues. The institute is researching issues such as how people respond to temperature, humidity, pollution and ventilation, and is developing technologies such as energy efficient air-conditioning. The Tropical Marine Science Institute is also conducting research in physical oceanography, marine biology and climate change. NUS also established the Singapore-Delft Water Alliance, with Delft Hydraulics, and one major research theme is environmental modelling which is key to understanding the effects of climate change on Singapore and the region.

4.29. NRF, in a partnership with ETH Domain, is setting up the Singapore-ETH Centre (SEC) on Global Environmental Sustainability under NRF's Campus for Research Excellence and Technological Enterprise initiative. The SEC will undertake research in areas such as human health, future cities, environmental monitoring and modelling, as well as clean water.

4.30. Climate change is expected to have a global impact on water supply worldwide. To enhance Singapore's capability in water policy research, PUB is collaborating with the Lee Kuan Yew School of Public Policy to establish an Institute of Water Policy (IWP). The IWP will engage in research, education as well as consultancy work in water management and policy for public sector organisations.

4.31. In March 2007, NTU also developed the Nanyang Environment and Water Research Institute (NEWRI), which will coordinate research in environmental and water technologies in various centres and programmes. The first of NEWRI's centres is the Singapore Membrane Technology Centre.

4.32. In addition to the numerous international collaborators and peer reviewers in the vulnerability study team, our local researchers also exchange information and collaborate with international experts on climate change-related issues. For example, in December 2007, the Tropical Marine Science Institute and the Department of Civil Engineering of NUS, and the British High Commission in Singapore jointly organised an expert symposium on "Climate Change: Modelling, Impacts and Adaptations". The symposium drew speakers and participants from the IPCC as well as renowned institutes such

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as the UK Met Office Hadley Centre and the Tyndall Centre for Climate Change Research.

4.33. The various government agencies, research institutes and our private sector have introduced a range of initiatives and programmes, which will build up our manpower expertise and technical competencies in Singapore. These efforts, along with the available funding for R&D and test-bedding, will enable us to mitigate CO<sub>2</sub> emissions and adapt to climate change in an environmentally sustainable and cost-effective way.