Chorh-Chuan TAN
President
National University of Singapore
Southeast Asia: Quick overview

Singapore & NUS
– selected R&D, and opportunities
The “iron” triangle in healthcare

Quality

Cost

Access
The sustainability “iron” triangle

Economic development

Environmental sustainability

Energy security

Quah, NUS Energy Studies Institute 2009
Projected 2010 economic growth = 4.9 - 5.6% (world 4.5%)

Energy demand to 2030 grow average of 2.5% every year (>>ROW)
Population 9% of world

- % share of world coal Reserve - 2009: 0.7%
- % share of world Oil Reserve - 2009: 1%
- % share world Nat Gas Reserve - 2009: 4%

ASEAN will be net importer of energy

Source: BP Statistical Review of World Energy – June 2010
Economic development

Environmental sustainability

Energy security
ASEAN Energy-Related CO2 emissions by country (reference scenario)

World Energy Outlook 2009 (IEA)
• Energy DEMAND RISING
• Mostly satisfied by fossil energy IMPORTS
• RISING CO$_2$ emissions

ASEAN countries looking into renewable energy sources
In the near-term (until 2030), alternative energy systems expected to make up a small but growing fraction of ASEAN’s energy portfolio.
Singapore - Unique Situation:

- Small (710 km²); Dense (7022 people/km²); Urban
- No natural resources
- We import almost 100% of our energy
  Little potential for wind, tidal, geothermal, biomass

Source: Statistics Singapore, 2009
SINGAPORE: ENERGY CHALLENGES AND DRIVERS FOR CHANGE

• Energy security options
  • natural gas
  • waste to energy
  • solar

• Reduce consumption, increase energy efficiency

• Increase electrification for urban mobility

• Clean energy as a growth industry.
  Government pledged $1 bn over 5 years for energy efficiency, green transport, and clean energy.
Natural Gas emits 40% less CO₂ than oil per unit electricity generated.

In 2008, Natural Gas made up 80% of total fuel for electricity generation.

Singapore Energy research that may be complementary to McDonnell partners:

- Reducing energy consumption in a tropical, Asian city
  - urban planning
  - building design
Reducing energy consumption in a tropical, Asian city

- Collaboration between NUS and industrial real estate firm JTC Corporation.

- Computer programme that guides planners on how to site buildings, plant trees or place ponds, among other measures, to dissipate heat.
Reducing energy consumption in a tropical, Asian city

Source: Dr Wong Nyuk Hien, NUS
Sustainable building design for tropics

- Collaborative R&D between Building & Construction Authority, NUS, industry on “zero energy building” in tropics

- S$5m fund to encourage local developers to link with foreign partners to develop building designs that can improve energy efficiency by at least 50%.

- S$100 million fund to help existing owners upgrade & improve the performance of their buildings
Singapore Energy research that may be complementary to McDonnell partners:

• Reducing energy consumption in a tropical, Asian city
  - urban planning
  - building design

• Systems-integration test-bedding in Singapore
Singapore: Smart grid test-bed

• World’s largest pilot 1 Megawatt Experimental Power Grid Centre

• US$27m facility

• Allows electricity from renewable energy sources to be fed into the Grid

Source: A*STAR – Institute of Chemical and Engineering Sciences
Singapore: microgrid test-bed

Powering Pulau Ubin with Clean and Renewable

Project aims to make Singapore a launch pad for new energy technologies

A preview of possible solutions

1 – Solar
2 – Solar
3 – H2 Storage
4 – Biomass Waste
5 – Energy Storage
6 – PV
7 – Marine Turbine
8 – Microgrid

Source: Energy Market Authority (EMA)
## NUS- selected areas of focus

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<tr>
<th>Institute/Department</th>
<th>Focus Areas</th>
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<tr>
<td>Solar Energy Research Institute Singapore</td>
<td>Li-ion batteries, H2 prod, storage &amp; fuel cells</td>
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<tr>
<td>NUS NNI</td>
<td>Sustainable design, construction, management</td>
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<tr>
<td>Centre for tropical building research</td>
<td>Multi-disciplinary with strengths in water R&amp;D</td>
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<tr>
<td>NUS Environmental Research Institute</td>
<td>Drive campus sustainability initiatives &amp; targets</td>
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<td>Office of Environmental Sustainability</td>
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NUS’ Solar Energy Research Institute of Singapore

Research Leadership
CEO Prof Joachim Luther, Former Director of Fraunhofer ISE 1993 – 2006
Dy CEO Prof Armin Aberle, Ex Dy Director UNSW PV Centre of Excellence

US$100 million & 90 Researchers / 5 years

R&D Clusters – Silicon Photovoltaics / Nano-structured Solar Cells / Solar & Energy Efficient Building including PV System Technology

Service Unit – PV Module Performance Analysis
Solar module testing & certification centre with VDE & Fraunhofer
NUS Energy Studies Institute

Analysis of impact of Singapore’s land transport policies on balancing private and public transportation, and on CO2 emissions

Major survey of companies (refining, petrochemicals, pharmaceuticals) on their programmes & commitment to energy efficiency

Works with Ministries to monitor:
- Global developments & trends in energy/environment/sustainability systems and technologies
- The economics of new innovations
- The geo-politics of fossil and emerging energy sources.

Future technologies
Potential areas for collaboration

- Sustainable urban planning & building design with lower energy requirements, for high-density cities in tropics

- Solar energy R&D

- Water-energy nexus: cheaper & less energy-intensive water reclamation options (water “pre-treatment via mangroves, nanotubes)

- Comparative energy policy studies
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Energy Studies Institute