Cleaner & Alternate fuels – Singapore
Perspective/Initiatives

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Agenda

- Singapore – Introduction
- Initiatives by
  - Singapore/Industries
  - SPC
Singapore

- Member of ASEAN
- Located in the Straits of Malacca

Area: 700 sq km
Population: 4.5 Million
Singapore

- 0.07% of World's population
- But, contributes to the world ....
  - 80% of Off shore oil rigs & FPSO conversions
  - 70% of Semiconductor
  - 30% of Hard disk drives
  - 30% of Hearing aids
  - 25% of Printers
  - 20% of Photo flash lamps
  - 10% of Refrigeration compressors
Singapore – Leader in Manufacturing

- Chemicals
- Electronics
- Precision Engg.
- Transport Engg.
- Biomedical Sciences
- Environmental & Process Engg.
Singapore – Other credentials

- Top 3 oil refining/trading center
- Top 10 petrochemical hubs
- Top 3 wafer foundries
- Top 5 major semiconductor companies
- Asia’s oil product pricing centre
- Major aviation hub – 4000 weekly flights
- Major shipping hub & Top bunkering port
  - 200 shipping lines to more than 600 ports
  - 17 % of total tanker calls solely for bunkering
Pollution

- One-third of world's CO2 emissions from SEA
- 6 of 15 most polluted cities in Asia (*UN Statistics*)
- Singapore one of the cleanest Asian Cities
  - Compares favorably with major cities in the world
- Major concern: PM 2.5 (particulates< 2.5 Microns)
  - PM2.5 has been linked to respiratory diseases and heart disease.
  - PM2.5 is 21µg/m3 (above the standard of 15µg/m3 set by USEPA)
- Pollution in Singapore
  - Transportation
  - Manufacturing
  - Power Generation
Singapore – A responsible global citizen

Commitment
- United Nations Framework Convention on Climate Change (UNFCCC) ratified in 1997
- Kyoto Protocol acceded in 2006

Action
- Singapore Green Plan 2012 (10 year initiative)
  - NCCC – National Climate Change Committee
Acceding Kyoto Protocol

- Kyoto Protocol ratified in 2006
  - To tackle global greenhouse gas (GHG) emissions.
  - To reduce carbon intensity by 25% from 1990 levels (In 2005, 22 percent below 1990 levels).
  - To improve energy efficiency

- Non-Annex I party to the Kyoto agreement
  - No legal bounding to specific emissions target.
  - Own targets established as part of NCCC.
Kyoto Protocol Opportunities

- Capitalize on opportunities from climate change
  - Alternative/emerging energy technologies under exploration

- International Enterprise (IE) Singapore initiative
  - iPartner – A consortium of environmental tech. companies
  - To seek opportunities in emissions reduction /carbon trading
  - Led by Asia Carbon, a pioneer in carbon emissions trading
  - Asia Carbon Exchange - First Carbon Exchange in Asia

- Designated National Authority established for CDM
Singapore/Industry Initiatives
Euro 4 Diesel Vehicles

- Diesel Fuel - 20% of vehicles in Singapore (taxis)
  - Contributes to air pollution (50% of PM 2.5 level)

- First to introduce Ultra low sulphur diesel in SEA
  - Euro 4 diesel introduced in December 2005
  - Expected to cut soot and noxious emissions

- Diesel Engine Vehicles to meet Euro 4 from Oct 2006
  - Pollution reduction by about 70 percent
  - Expected to reduce Particulate matter (PM2.5)
  - Carmakers adding complex filter/exhaust systems
  - 80 percentage point cut in additional registration fee (ARF)
CNG

- CNG Taxis encouraged
  - Green Vehicle Rebate offered
  - Exempt from Special tax until Dec 2007
  - More than 340 CNG vehicles currently

- CNG – A cleaner and cheaper fuel
  - CNG Vs Diesel (65 Vs 107 cts/ltr of fuel equiv.)
CNG

- CNG-driven cars
  - Emit 20% less CO2 than petrol-driven models.
  - Switch to petrol when run out of gas.

- CNG re-fuelling infrastructure.
  - $2 million grant from NEA for 2 new CNG stations
  - A natural gas supplier to build the third
  - Present status: one CNG refueling station
LNG terminal

- LNG Terminal in Singapore by 2012
- First in South East Asia
- 3 MMTPY LNG Terminal
  - (S$800 million)
- LNG – Fuel for power generation
- Cleaner fuel source
- Long-term strategic benefit to island/region.
Fuel Cell & Hydrogen Technology

- Projects on developing H2 and fuel cell applications

- Singapore Initiative in New Energy Technology (SINERGY)

- Mobile fuel cell application
  - Committed to a vehicle test bed since 2001
  - Personal Transporter Vehicle

- Stationary fuel Cell application
  - Power Systems
  - Carpark Lighting
Fuel cell vehicle testbed project

- DaimlerChrysler & BP spearheading since 2001
- Six hydrogen-powered fuel cell cars on the roads
- Hydrogen Source: BP Hydrogen refuelling stations
- Test data to be compared with other parallel test-beds
  - US, Canada, Japan and Europe
- Singapore - ideal test site for the demonstration
  - Well-developed urban road system
  - Playing pivotal role in commercialization of fuel cell cars
The FOX is a three-wheeled transporter

- Ngee Ann Poly and GasHub Power Pte Ltd

- Powered by a fuel cell that emits only water.

- Top speed of 15 km per hour

- For up to 2.5 hours at a time.
Rolls-Royce ties up Enertek Singapore
- To develop a commercially viable power systems
- Investment about US$100 million
- Plan - a commercially viable 1 MW power system by 2008.
Fuel Cells – Other initiatives

- Multi-storey carpark lighting project in Singapore
  - Field-testing of a 5 kW fuel cell power system
  - System will run on H2 reformed from CNG
  - Five-party collaboration:
    - DRPL & IdaTech LLC (fuel cell supplier)
    - HDB, NTU & NEA
Hybrid Cars

- Use of environmentally friendly or "green cars” promoted
  - Fuel Cell Cars – not commercially viable yet
  - Hybrid Cars – Commercially viable

- Hybrid cars qualify for Green Vehicle Rebate (GVR)
  - GVR is an initiative from NEA to promote “green vehicles”
  - Introduced in January 2001 is extended till December 2007
  - Rebate doubled from pre-2006 level of 20% to 40% of the Open Market Value (OMV)

- Hybrid cars run on petrol and another source of motive power
  - Usage of less fuel (savings on petrol)
  - Lesser emissions
Solar Power

- Solar-powered Applications under exploration
  - Home Water heaters
  - Canteens
  - Community Hospitals
  - Country clubs
  - University Hostels
  - Hotels
  - Airport Services
NEA Initiatives - NCCS

- Aims to reduce Green House Gases (GHG)
  - Energy efficiency and conservation measures
  - Use of cleaner Fuels that emit less GHG (NG)
  - Primary greenhouse gas – CO2
  - CO2 emissions
    - Generated from energy use.
    - Linked to global warming and climate change
NEA Initiatives – Energy Efficiency

- Accelerated Depreciation for Energy Efficient Technology
- Energy Labeling Scheme - Appliances
- Energy Smart Building Scheme – Offices
- Fuel Economy Labeling Scheme - Vehicles' fuel efficiency.
NEA encourages energy efficient equipment and technology

1-year accelerated depreciation allowance on Capital Expenditure

Inefficient equipment
- Incur high operating costs as they consume more energy
- Higher emissions – negative impact to the environment

Scheme to encourage companies
- To Replace old, energy-consuming equipment with energy efficient ones
- To invest in energy-conserving equipment
Energy Labeling Scheme - Appliances

- Introduced for air-conditioners/refrigerators (2002)
- Mandate on all air-conditioners/refrigerators (2007)
- Plans to extend to clothes dryers, dishwashers and water heaters
- Consumers can make informed choices
- Savings on utilities bill -
  - Energy consumption a significant part
Energy Smart Office Schemes

- NEA partnership with NUS
- Recognizes energy efficient office buildings
  - Based on energy-efficient benchmarking
- Saves energy cost
- Healthy Indoor environment
Fuel Economy Labelling Scheme

- Scheme for Passenger Vehicles
- Part of the Singapore Green Labelling Scheme
- Administered by Singapore Environment Council and NEA
- Fuel economy information readily available at point-of-sale,
- To raise consumer awareness of fuel economy
- Enable informed decision for Consumers while purchasing new vehicles.

- Fuel Economy Labels
  - Affixed on all show room vehicles (registered)
  - Displayed at the top right corner of front windscreens.
  - Provides information on fuel economy of vehicles
  - Common test standard - Fair comparison between vehicles
Car population/traffic control
Quota for Cars for every month
- As high as US$ 63 K
Car traffic in business zones
Biodiesel

- 4th leg for Singapore’s Economic Development
- Govt. supporting Bio-diesel Investments
- Three new Bio-diesel Investments in Singapore
  - Continental (up and running)
  - Natural Fuels – Australia
  - Peter Cremer
- Test beddings going on
- No mandate to use Biodiesel yet
Other initiatives

- Jurong Island
  - Located far off from community neighbourhood
  - Residents protected from pollution
  - Promotes industry synergy

- Pulau Semakau
  - Single point disposal for Industrial waste

- Storage Caverns
  - Crude and petroleum products
  - Safe and efficient storage strategy
SPC/SRC Initiatives
SPC Introduction (www.spc.com.sg)

- SPC is an Integrated Oil & Gas company Owns 50% of Singapore Refining Company (SRC)
  - Member of ASCOPE
  - Member of OIESC

- Singapore Refining Company (SRC)
  - 285000 bpd complex refinery
  - Located in Jurong Island
  - In operation from 1973
Emissions Target

- SRC in full compliance with all Air Emission Regulations
  - Point source emissions
  - Refinery bubble based emissions.
  - Close monitoring and effective emission management
  - SOx emissions below the monthly cap set by NEA

- SRC targets to improve energy efficiency Year on year
  - In terms of Solomon based EII
  - EII is widely used measure in the refining industry.
  - Current (2006) = 85.6; Future (2010) = 83.0
Emission abatement - Fuel

- Energy conservation
  - To improve fuel efficiency
  - To lower works fuel consumed per bbl of crude
  - Fuel gas only design on all newer process units.
  - No fuel oil firing post-1995

- SRC has progressively lowered its EII
  - 95 in the year 1996 to 85.9 in the year 2005.
SOx Abatement – Sulphur Units

- Sulphur Recovery units (SRU) Improvements in 1995
  - Capital cost of **S$ 54 million**
  - To improve recovery efficiency

- 4 SRU’s converted - 2 to 3 reactor stage
  - Increase recovery efficiency from 94 to 96/97%

- Installation of Foul Water Strippers (FWS)
  - FWS off-gas was stripped off H2S
  - FWS off-gas incineration avoided

- SOx lowered by 31.7% compared to 1992 levels.
Clean Fuels

- Singapore may move to Euro IV directly (Mogas)
- Diesel 50 ppm production capability
- Diesel and Mogas Clean Fuel projects under feasibility evaluation (US$ 200-300 million)
NG fired Cogeneration plant under discussion
Expected to lower EII
Indirectly contributes to SOx reduction
Cleaner way of producing energy and steam
Energy audits Scheme

- Initiated by National Environment Agency (NEA)
  - With major industrial consumers under National Climate Change Committee (NCCC)
  - A voluntary scheme launched in 2002.
  - Audits are carried out every 3-5 years
  - Audited by in-house staff or external energy audit specialists

- To encourage industries that use large amount of oil and gas
  - To put in a formal system for energy management
  - Identify opportunities for improving energy efficiency regularly.
  - Take measures to improve the energy efficiency
Energy audits

- Potential benefit of the Energy Audit Scheme
  - Saves cost
  - Improves companies’ competitiveness.
- SRC – An active participant in the scheme
  - Committed to improve energy efficiency
  - Mitigate the environmental impact
Thank you