SOUTH ASIA REGIONAL ENVIRONMENTAL SECURITY FORUM

DAILY NOTES

Co-Sponsored by: | Maldives National Defence Force and the U.S. Pacific Command

South Asia Regional Environmental Security Forum 2014

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COMPILED FORUM NOTES

WRITTEN BY KAWAKAHI AMINA CTR, USPACOM J81

MALDIVES DAY 1 (JUNE 2nd, 2014) - Water Security

Opening Ceremony

Maj Gen Richard Stevens (*US Army Corp of Engineers*)

- Sustained commitment to rebalance to pacific.
- Enable alliances and partnerships. Regional and environmental stability and prosperity.
- Disaster preparedness
    - Jakarta: 14 countries met to discuss pollution, global warming, overfishing
    - Sydney: 17 countries military sustainment and planning
    - Maldives:
    - Thailand (next):
- What trying to accomplish: operationalize environmental security. Move into implementation phase. "ideas into action"
    - Water: integrated water resource management
    - Waste: waste-to-energy system, low-cost alternative approaches that we can operationalize
    - Resource Protection: TTX

HE COL Mohamed Nazim (*Ministry of Defense Maldives*)

- Borderless world that we face today.
    - Debilitating effects of climate change.
- 80% of Maldives exist within one meter of the sea level
    - 10-100cm by 2100
- Tourism is 60% exchange receipts, 25% of GDP.
    -

Introduction to Water Security Theme

MAJ GEN Richard Stevens (*USACE*)

- Sustaining security and prosperity are directly linked to how the region is able to implement the insights gained from this forum.
    - What is water security?
        - No set definition of "water security"
            - United Nations:

1. Water security is drinking, food, fish, energy, transportation, all depend on maintain productivity and health.
2. Capacity of a population to safeguard access to water to sustain life for peace and political stability.

- Why is it important?
  - Water is interwoven with food, energy, infrastructure, etc.
  - By 2025 2/3rds of the world can experience water hardship.
    - During the next 10 years many countries will experience water shortages.
      - Beyond in shared basis will be used as leverage amongst nations
      - Decline of food productivity
- What is USACE doing about it?
  - USACE has been working since 1802 both domestically and internationally.
    - Regularly conduct international projects for integrated resource management. Flood risk management and access to clean water.
    - Growth in South East Asia has stressed water resources.
  - Dam safety, understanding risk for dam construction and safe operation. Support development of dam safety programs.
  - In Sri Lanka to gain access to clean water, previously. USACE has attempted to connect 100 homes to connect to water lines.
- Lessons learned:
  - THINK DIFFERENT: Traditional way of managing water is compliance driven.
  - PROACTIVE: Need to be proactive in planning i.e. climate change
  - INCLUSIVE: Need to involve all stakeholders from basin with a focus on SHARED use
  - LEAD: Effective leadership needed
- Suggestions for other militaries
  - Identifying and assigning a water management champion. Excellence in water. And maintain a water security expertise, clearly identify water responsibilities, and accountability to insure water is a priority.

Water: A Potential Trigger for Conflicts?

Dr. Herath Manthrithilake (*Sri Lanaka Development Initiative*)

- Working in water arena for a long time.
- Water security:
  - The ability to access sufficient quantities of clean water:
    - For drinking and for proper sanitation
    - Maintain adequate standards of food and good production
    - Sustainable environment
  - Water is central to development
    - Relationship between water supply and demand within a country
    - Availability of renewable water resources
  - South Asia Diversity

        - South Asia has 23% of world population on 4% of world's landmass
            - Diverse in terms of religion, language, ethnicity, traditions, values, etc.
- Assumptions
    - Cultural norms often drive water policies and will continue to do so in South Asia
    - Present status of policies and strategies will not unlikely change significantly
    - Conflict is likely to spread and intensify as a result of the lack of water security.
- Food production (agriculture)
    - Irrigation is critical for economic development, 40% of cropland is irrigated, and irrigated agriculture provides 60-80% food for the region.
    - The region:
        - Highest rates of irrigated agriculture
        - Oldest and largest irrigation systems on earth
        - Stagnant over the last decade and on the decline
        - Decreasing in size of tanks
        - Because of failing of tanks, farmers are opting for smaller private wells
            - Benefits: easier to maintain, flexible
            - However, extract rates are very high
    - Challenges
        - Development pressures
        - Ecological insecurity
        - Policy and management failures
        - Low efficiency resulting
        - Over-dependent on subsidies (energy, fertilizers, etc.)
        - Inefficient conjunctive water use
        - Trans-boudry issues both and within and across countries
        - Limited technologies
        - Inadequate R&D
        - Underdeveloped water markets (can pay for someone to pump water, not as developed)
    - Irrigation
        - Heavily irrigated areas is spread across 1200 mile in Pakistan
        - Decreasing groundwater
        - Pumps and wells are also increasing.
    - Unsustainable water use
        - If measures are not taken:
            - Reduction in agricultural output
            - Shortages of potable water
    - Water Pollution
        - Water quality kills more people than war
    - Transboundary water
        - All major rivers are sourced by the Himalayas which have more ice than polar ice caps
            - Billions of people depend on this water
        - 10% reduction and it could disappear by 2035

        - High-altitude glaciers in the region are no longer accumulating ice
        - Melting glaciers:
            - Will result in floods
            - Water shortages could lead to serious cross-border water wars
            - Increase in temperature will dictate the times of desperation
        - By 2043 the tropics will have serious climate change
    - Vulnerability
        - Lack of policy and institutional failures → will result in social unrest
        - Lack of adequate water could destabilize some countries
    - Three water treaties:
        - Indus Waters Treaty: between Pakistan and India
        - Ganges Treaty: between Bangladesh and India
        - Mahakali Treaty: between India and Nepal
    - Water as a source of peace:
        - Joint water governance has created cooperation on broader issues
    - Regional tensions:
        - Acute water shortages looming water in shared basins will increasingly be used as leverage (Uzbekistan)
- Key Messages:
    - South Asia will face major challenges with water problems
    - Water shortages will lead to state failure, water insecurity
    - Countries already experiencing internal and cross-border tensions
    - Water stress, potential to threaten stability

Grounding the Water Security Debate: Balancing 'Eagle-Eye' and 'Toad-Eye' Sciences for Semi-Arid South Asia

Mr. Dipak Gywali (*Ministry of Water Resources*)

- Mountain hamlet is like an island similar, surrounded by verticality.
    - Very difficult to get water up to the top of the mountain from springs. A lot of water is gathered from rainfall.
    - Semi-arid: 7 months without rainfall
        - Water is a "wicked" problem:
            - Water is a problem when you cannot agree upon a definition (legal program, waste management problem, political problem, etc.)
            - Problems:
                - There are large energy costs
                - Multiple uses of it
        - Who's perception of risk and how do manage it?
- "Toad-eye" science is needed to complement higher level "eagle eye" science. NEEDS TO TEST AND EVALUATE SYSTEMS at the grass-roots level.
    - Water management under Climate Uncertainties
        - Example 1: Flooding of Nepal
            - Flow in the river is average, however there is a larger problem of corruption, faulty treaty and mismanagement.

        - Wrong choice of technology to mitigate disasters instead should have focused on elevated houses etc.
    - Example 2: Pump irrigation
        - Farmers know better than economists and engineers about
        - Turned the pump into a truck and then was able to use the vehicle to pay off the loan in two years.
    - Example 3: Well runs dry
        - 4-different approaches (SEE PHOTO)
    - Example 4: River linking
        - Massive plans of river linking, from the east to flow to the west and south.
            - The problem is that the actual amount of rain water on that area is all coming down in 4 months and it is mostly a dry landscape.
        - Civil Engineering = cement engineering
        - Different types of technologies to solve the problem (natural dam, cement dam, cheap pump)
    - Example 5: Himalayan Water tower
        - Over pumping NOT climate change
    - Example 6: Cloud bursts
        - Not studied, need more studying (Bishyari)
    - Example 7: Landslide damming

- Takeaway
    - Cultural theory of resources; bad engineering coupled with faulty economics
        - Social solidarities
            - Hierarchy: government, military
            - Individualism: equal market players
            - Egalitarianism: Activism
            - Fatalism: passive consumers and voters
        - Four types of water:
            - Water as a public resource
            - Water provided through market
            - Water is a club good (membership only)
            - Water is for all
        - Four perceptions of risk
            - Markets
            - Governments are risk averse
            - Egalitarians magnify risk to maintain group structure
            - Individualism
        - Social Response
            - (SEE PHOTO 1)
            - Data is treated as part of the power structure. (SEE PHOTO 2)

    - i.e. during the dam construction the dam was only rated for 8000m/s, there was some outlying data that indicated there was a 12000 historical flow. The actual flow on the flood day was 16000.
        - SEE PHOTO 2
    - Defining the water security problem, there are multiple viewpoints hence there are multiple definitions.
        - As a consequence there will be largely differing solutions as well.
- ANSWER IS many 10% solutions
    - Need a balance of government, market, and egalitarianism
- They can only be dealt with only by uncomfortable knowledge generated from a "toad's eye view" based on household risk perception
- Clumsy solutions from not just neat procedural hierarchism, but also informal market individualism and civic egalitarianism
- Bring us to rethink sustainable as understood by informal households.

Maldivian Water Security Concerns

Mr. Mohamed Rasheed (*Male Water & Sewerage Company*)

- Problem of managing water and waste in a country with 1190 islands. 300 km^2 of land
- Water security in the Maldives
    - Safe water not available for >50% of population
    - Rainfall dependent, relies on aquifer extraction and recharge
    - Safety and security is an individual responsibility, each family can have their own well
    - Demand and supply left as a Laissez-faire matter
    - 3months of no rain, 9 months of rain
        - Before 2 epidemics per year till 1988. After that rain harvesting was focused on.
        - After the tsunami almost all tanks that were created are gone.
- Concerns
    - 8 islands managed by MWSC (about 38% population of the country)
        - Uses about 97% of the desalination capacity of all the system
    - 2 managed by others (about 700 households)
        - <2% of the production capacity of the country
    - 27 are unmanaged
        - Have desalination may/may not be working,
- Concerns/Outcomes
    - Inadequate safe water and sanitation facilities →death, disease, and poor health
    - Rapid urbanization of Male since the 1970 → continuous struggle to meet the water demand
        - Initial demand is above 20,000m^3/day, currently exceeds this
    - Poorly managed ground water → over exploitation and pollution
        - Salt water intrusion due to over-pumping. Water not safe for even flushing the toilet.

- Global warming and rapid changes in weather patterns → shift in monsoon patterns and drought
  - Water that normally has a chance to recharge the system are instead pumped into the ocean and now allowed to absorb.
- Cross boarder pollution → water quality affected/need for alternate water sources
- Environmental enforcement issues → quality of water becoming unsafe
  - Water network uses poly-ethylene pipes that is permeable to hydrocarbons
    - Oil seeping into the pipe system due to illegal dumping
- 2004 tsunami → 95% of the water tanks constructed were completely destroyed.
  - Lots of islands that had vegetation were destroyed
  - Septic tanks were also ruptured and released to the ground
  - Still unable to meet demands, more people are migrating back into the capital city.
  - Pipe network was designed for 100K people for 2020.
    - Pipe diameters are too small, and unable to supply demand
- Negative economic factors → escalation in cost production and limits expansion
  - Rate of borrowing up
  - Exchange rate up
  - Fuel prices up
  - Inflation up
- Need to act beyond MWSC capacity → negative perception
  - MWSC has not had a system breakdown longer than 3 hours

- MWSC Strategy Ahead
  - New businesses: Not making that much profit, bidding for government contracts to other islands
    - Now becoming from an engineering company not just a utilities company
    - Started bottling factory, 3rd largest water bottling in the country
    - Pipe manufacturing and well services
    - Water quality analysis
  - Promote sustainable environmental practice
    - Encourage green development, net zero
    - Increased use of solar power for energy
    - Increase contributions toward environmental stability
- Action Plan (SEE PHOTO)
  - Revise water tariff, unable to expand services on Male
  - Redesign distribution network, increase storage capacity and fuel
  - Increase power generation capacity
    - Increase from 20K to 30K water production
    - Diesel to 7MW capacity/day
    - Renewable energy 3MW capacity/day
    - Increase fuel storage

Water Security Panel Session

- Key takeaways:
  - Unaddressed conflicts

- Solutions that need to be at the ground level and top driven (many 10% solutions)
- Local impacts to a complex small system

Water Security Panel Questions

Q: Single greatest threat to water security?
A: Change in lifestyle, flush toilets, etc. Turning our water resources into a new category as a sewage.

- Need R&D to turn putting our waste into a system not use water as the final point.

Q: Statistics heading to water stress. Why is water stress not an agenda political?
A: Need work at the activist/NGO level, since waste water treatment is not "sexy"

- Need to change the vocabulary

Q: Economic value of water in a trans-boundary situation?
A: Biggest challenge is the multi-purposes of water has multiple benefits but also have multiple harms.
A: Need to solve the internal issues. Different stakeholders have different interests, need to balance these.
A: smoke from burning Indonesian forests, smoke raining from China and India, when approached with these issues they have helped build infrastructure in Maldives.

Q: How will climate change affect the water lens in the Maldives?
A: 1983 water lens was 20m length. So long as there is no over extraction then the process will go on forever. In 1985, pollution from the top and salt water from the bottom.

Q: What are some initiatives that can be "quick wins" for a long term strategy?
A: Take all stakeholders and hear everyone perspective.
A: Education is a quick win, and give up the idea that water is common good. Need to accept that we must pay for the service
A: Education, we have ignored the front and back-end. We have taken water is a free good and cannot use water as our common waste disposal site.

Integrated Water Resource Management: Shared Vision Planning Overview

Dr. Michelle Haynes (*USACE*)

- Process that promotes a coordinated development and management of water, land, and related resources. In order to maximize the resultant economic.

MALDIVES DAY 2 (JUNE 3rd, 2014) - Waste Management

Introduction to Waste Management Theme

Mr. Hassan Shah (*Maldives Ministry of Environment & Energy*)

- Waste management similar to water in importance.
- Collection, transport, processing, and/or disposal that human generate for basic needs. Opportunity to think outside of the box, lessons learned, and experiences.
- South Asia region is under immense pressure due to population explosion, lifestyle changes, etc.
    - Many cities are not adequately manage the waste they generate, due to international and technical shortcomings.
    - Solid waste is one of the most visible threats to the Maldives.
    - Small size of scale highly limits the economies of scale for waste management.
    - Special attention to best choice of waste management technologies.
    - The waste management currently is burning at low temperatures, contaminates air and fresh water lens.
    - Waste management infrastructure is very desirable. 90% of waste is organic.
        - 1% is hazardous
        - 3% is recyclable household waste
- Need policy framework for waste management, currently fragmented.
- Waste management systems should be self-maintaining to pay for itself.

Post-Disaster Debris Clearance: Rana Plaza Collapse

Brig Gen Ibene Fazal Shayehuzzaman (*Bangladesh Ministry of Home Affairs*)

- Debris clearance coupled with the disaster response makes it a very unique experience.
- 9 story building, upper 5 were government factories
    - 1132 dead 2421 injured
        - Deadliest garment factory accident
        - Deadliest accidental (rated 2nd after the 9/11 attacks)
    - Collapse pattern types (SEE PHOTO)
- Multiple types of people joined together to
    - Need for layered and mutually supportive response
        - Gov't, non-gov't and private organizations
            - Army took lead (HQ was 6km from Rana Plaza)
            - Community and local volunteers were the pioneers
            - Fire and Civil Defence was one of the key players for the manual rescue operations
            - Engineering units were key players for the mechanical rescue operations and debris clearance
    - He was involved from the beginning to the end.
        - Central coordination committee was formed
- Rescue Operations
    - Rescue operations were conducted sequentially
        - The confusion and the inflow of people was the first obstacle

        - Debris clearing, database people management
    - Manual rescue operations from 24 April to 28 April 13
    - Mechanical rescue operations from 29th
- Building owner was not in compliance
    - Most affected people were the underprivileged and the poor.
- There were some hollow portions (voids) were people were spared.
- Rescue effort was slow, until there were signs of life.
    - Process is still on to identify the remains

Debris Clearance Operations

- Policy guidance
    - Disaster management act, policy, standing orders on Disaster 2010(SOD)
- Limitations
    - SOD 2010 was widely circulated in 2012. (POLICY GAP)
        - Debris management not covered in the SOD
        - SOD has a very narrow focus on Structural Collapse
- Quantity of Debris
    - 24000 cubic or 12000tons
- Debris clearance
    - Done on no profit basis with government and non-government support
    - Lifesaving operations followed by debris removal in April 29.
- Types of Debris
    - LOOK AT PHOTO
- Threat Determination
    - Entrapped people need O2
    - Further collapse with rescuers inside
    - Entrapped CNG vehicles in basement
    - Destruction or disruption of utility services
    - Threat to neighboring buildings
- Debris Management Concept
    - Dead body management
    - Debris management site and recycling sites
    - Final disposal by DCC
- Remaining debris recycled by local administration
    - Curbside collection with a combination of mixed and segregated materials
- Lessons Learned
    - Major earthquakes would cripple the city
    - Role of gov't, non-gov't, and private entities are UNDEFINED
    - Different stakeholders follow different methods for debris removal, no particular guideline for recycling disposal, etc.
    - Varying list of equipment for debris clearance
    - Contaminated debris, mortuary affairs are UNDETERMINED
    - Debris hauled distance is long with no designated space for disposal

Regional Approaches to Solid Waste Management in South Asia

Ms. Chamina Priyankari Alexander (*South Asia Co-operative Environment Programme*)

- Overview of SACEP
  - Inter-gov't cooperation of 8 member states, established in 1982, created to promote:
    - Cooperative activities of mutually environmental concerns
    - Extend support for knowledge and expertise
    - Maximize of support of donor countries
  - 10th governing council areas of priority:
    - Waste management
    - Climate change
- South Asia Region
  - Second fastest growing region in the world
  - Population is 1.4B pax currently
  - 40% of the world's poor in rural areas
  - By 2050 estimated population is 2.2B pax
  - Problems
    - Resource depletion, lack of access, toxic and hazardous waste, vulnerability to natural disasters.
- Waste Management Currently
  - Open dumping is the first preferred waste management practice, followed by composting. Interest in small scale composting is due to large organic component.
    - No structured waste management organization
    - SEE PHOTO
- Afghanistan
  - 3M pax in Kabul, 300T of solid waste per day.
  - 2K workers and 110 trucks still cannot be
  - Dumped in Chemtala plains (7km N of Kabul). Waste is uncovered and gets washed out during heavy rains.
    - New planned landfill
- Bangladesh
  - 23M pax currently, expected to increase to 58M (by 2020)
  - Average waste generation of 149.7kg/yr per capita
  - 4000MT of waste 200T hospital waste, 40T of which are infectious waste
  - DCC is responsible for solid waste
  - Only 42% of waste is collected, remainder is dumped on roadside or open spaces
  - National 3R strategy passed in 2010: Reduce, Reuse, Recycle
  - Landfill and upgraded waste management unit planned
- Bhutan
  - 634K pax, 31% in urban locations
  - No landfill site
  - 50T from capital city per day, 193.5kg/yr per capita
    - TCC is responsible for waste management
- India

  - 17% of world population
  - 182.5kg/yr per capita, 226B TN/yr
  - 48000T of tons per day/ 17.5M T per year
  - Most waste is disposed in unsanitary landfills
  - Only 300mT/day is processed for composting
  - All 3 landfills are completely full
  - 23 metro cites generate 50kT are generated Daily
  - Decentralized Green Waste management
    - Potential work with biofuels
- Maldives
  - 20 atolls, 1190 coral islands
  - 312MT of waste generated per year, 1kg person/day in Male
  - Waste dumped near beach or into ocean
  - In 1970 waste was sent to Thilafushi
    - Non-engineered low-lying island with facilities aboard
    - Two potential other sites planned
- Nepal
  - 24.2M pax, 85% live in villages
  - 524000T/yr, 83% is municipal waste, 6 industrial, rest is agricultural waste
  - No landfills
  - 115.7kg/yr waste per capita
  - Most land is dumped into landfill along river
  - Capital city 335ton/day
- Sri Lanka
  - 19.25M pax
    - 64,000T of waste per day generated; 215.4kb/yr, 4.4M
    - Daily waste collection is only 2,683 T
  - Colombo is 645k people alone
  - Garbage often attracts cattle, crows, and even elephants
- Pakistan
  - 22MT/yr
  - 127.0kg/yr per capita
  - 54,850T of solid waste generated daily
  - Total waste generated is 425 tons per day

Our Success Stories

- Annakshetra Initiative
  - Aim at minimizing food waste by effective channelizing from wedding, parties, restaurants, temples, then given to deprived groups.
  - 10-20% of food waste in these events (1500 hotels, etc.)
  - Food is stored in deep freezers and tested for quality
    - Then distributed in slums, 1000 people fed per day more during wedding season and festivals.
  - 24hr help line

  - Ex. Was able to feed up to 6000 people during one festival season
- Sri Lanka National Solid Waste Management Program
  - Aim of project construction of small/medium/large composting plants for 93 local authorities
  - Construction of sanitary landfills, with help from Korea
  - Provide 450 sets of waste separation bins and 30k composting bins
  - Distribution of 19 waste handling equipment
  - Training, biomass plants, waste management activities, strengthen legal framework.
- E-Waste Management in South Asia in 2007
  - Develop proposals for e-waste disposal
- International Costal Cleanup Day
  - Since 2008 organized beach clean-up

Desktop Demonstration of a Waste Management Unit in an Island Environment

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Ms. Nicole Griffin (*MARFORPAC*)

- What it would take to site a system such as MAGS and some of the lessons learned.
- Waste manage is difficult due to limited resources, sensitive of water resources, and limited land.
- Solid waste management is an issue for everyone.
  - EX: in Hawaii refuse has small refuse near homes. Trench landfills after that, then further waste collection. Number of laws established to protect water, air, and land.
    - The environmental waste managers have been always one step behind the industry (i.e. beverage bottles in the 1970s)
      - The same thing occurs nowadays with e- waste (iPad, iPhones, etc.)
  - Island Waste management challenges
    - Without proper management there can be a contamination of water lens.
- Good waste management limits vectors, air emissions, and water emissions.
- Solid Waste Characterization
  - Types of waste
    - Pressboard goes to W2E
- New Technologies
  - Military bases during expeditionary
    - MSW Power: consumed 2-3T of waste per day; enough to power a house
    - Terragon: MAGS system
- Desktop Demonstration
  - Locating a system
    - Thulusdoo Island
      - 0.404 mi
      - Small population

1. Need a environmental baseline survey (EBS)
   a. Western side gets less wind
   b. UN constructed landfill in 2004 after the tsunami
      i. Currently fully and now locked

2. Permission from Island Council
3. Permission for transport and harbor use
4. Permission from landowner
5. Proposal to MPE
6. Permission for ash removal

- Close Out
  - Are effluents properly disposed
  - Are maintained disposal manifests in your records?
  - Is the site cleaned and returned to its original condition?
  - Have you completed any other mitigations?

Waste Management Panel Session

- What kind of training before the Rana Plaza incident would have been useful?
  A: Organizational reform, manual did not address debris clearance or structural collapse.
  - We have light, medium, and heavy response teams. More training is needed.
- Q: For the success projects did you have any environmental impact studies?
  A: There was an EIA done the other in India, not sure about that one.

- Q: How do you evaluate the success? Is there any participatory?

- Q: What exactly is that can an Army do to increase resiliency of a town (who are the first responders often).
  A: local community lacked leadership and was motivated by emotions, also luckily the Army was only 6km away. Volunteers are going to be employed as first responders.

- Q: What can we do to decriminalize waste management (mafia, yakuza, etc.)
  A(NICOLE): In the US the EPA also has top 10 most wanted list that enables law enforcement.
  A(NICOLE): In the US we need to pay to dispose of waste via tipping fees, as a result its difficult for a criminal element to enter since the local municipalities are the benefactors of the waste.

  A(CHAMINA): Training program for the policy makers to give awareness on the disposes of trash.

  Q: MAGS, can you give more specifics?
  A: Scrubber water is fresh water with 1gal a day being used, will need to re-plumb the system for corrosion resistance.
  A: Small amounts less than 10gal a day of fuel.

  Q: What was the causes of the Rana Plaza? Were there any signs or signals? Any notifications of failure?
  A(SHAH): The incident was triggered; emergency response company is tasked with first response. Engineering and life support units then sent out. To prevent such disaster in the future we have implementation of the rule of law. Normally, more than 60% of the city is committed to building, but in Bangladesh it is less than 20% as a result more buildings are built

on each other. Tracking the structures and how buildings are created (building codes) to monitor future expansion.

Q: Is there any policies set for trans-boundary air pollution in the South Asia Region? We have ones for water.
A: We have The Male Control of Prevention of Air Pollution, adopted in 1998 by ministers of government in Male. All countries in the region are in CETA except for Afghanistan (replaced by Iran). Monitoring heath and corrosion impacts. CETA has done work establishing stations along all countries to monitor the impacts of trans-boundary air pollution. Have finished phases 1-3 and moving to phase 5.

Q: Is this technology is only going to be placed on Thulusdoo?
A: No, this just a desktop.

Q: Waste management is just 20ft, from where the people live. What would be the temporary solution for it?
A (HASSAN): We have similar problems across the country, our first steps is to improve existing facilities. First option is to go for composting since 70% of our waste is organic compostable waste. The west can be removed or treated (to some extent).

Q: What type of support can the military do for waste management?
A (McLEOD): Work to provide prepositioned equipment to mitigate debris removal and technology development.

Q: What are the next phases of SARCEP?
A: It is a regional program so need to implement in all countries at the same time. We have planned to provide training programs.

Maldives Solid Waste Management Tour Overview

- Maldivians are sinking in their own waste. Thilafushi is an island that rose out of the sea by depositing trash on it.
- Thulusdhoo is a “typical” Maldivian island. Island was originally the capital island of Male atoll, greater decline after the 2004 tsunami.

MALDIVES DAY 3 (JUNE 4th, 2014) - Resource Protection

Introduction to Resource Protection

Brigadier General Ahmed Shahid (*Maldives Department of International Defence Cooperation and Policy*)

- In the Maldives we have all the challenges we have that are discussed in the forum. We challenge you to come up with a strategy and actionable ideas
- Going to talk about resource protection and understand ways to continue to use them without exhausting them completely.
- Protection of these resources are vital to our existence.
    - Air
    - Water
    - Soil
- GMOs, limit biodiversity. Climate change.
- Increasing demand of fishing has resulted in illegal fishing and negatively impacts fish stocks.
    - Local fisherman depend on these fish for the lively hood
    - 60-80cm sea level rise, 2-3degree temperature change/yr
- Encourage the invention of new technologies for greener and cleaner ways to prevent the Maldives from being "environmental refugees"
- Learned a lot from hotel development and has taught us to build our homes in lagoons and away from the beaches and shores.

Payment for Environmental Service: A Tool to Achieve Poverty Reduction & Environmental Security

Mr. Keyvan Izadi (*SNV Netherlands Development Organization*)

- Implement local poverty alleviation and sustainable development solutions at the local and regional levels as an aggregate have a significant global impact.
- Environmental security means different things to different levels.
    - Sound bites from previous speakers:
        - "toad level"
        - Operationalize
            - PES has lived on economists laptops for years, now they have shared it and operationalizing environmental protection
        - Resilience
        - Sustainability
            - Multi-generational, not a 2-3yr project cycle. What is the progress on the ground over a series of generations
        - Partnership
- PES: conditional payments by environmental service buyers to the providers for defined conservation related activities. Water is a good example.
    - Recipients compensate upstream, in this example forest conservation.
        - "Pay for performance:" upstream providers are earning the funds.
        - Cash transfers that are distributed at the local institution. Very transparent process.

            - Revenue is spent on community development (infrastructure development, scholarships, etc.)
        - Does NOT solve all environmental problems.
            - However, every time there is an intersection between

- Categories of PES:
    - Water
    - Biodiversity
        - Pharmaceutical companies have bio prospecting that are perfect for PES application.
    - Scenic beauty
        - Proper waste management (trash collection, etc.)
    - Human-wildlife Conflict
        - Bhutan: 72% and growing for forest conservation.
    - MPA
        - PES is a good tool for offsetting the opportunity cost of conservation.
    - Carbon
        - Complicated, will focus on other topics
- Why PES?
    - Traditional markets favor consumption
    - Recalibration is needed for 7 billion people.
    - PES has the ability:
        - A substantial step toward full accounting of "real costs"
        - Can help in reconnecting, by giving people the right incentives to protect their environment
        - Helps generate egalitarian relationships
- When PES?
    - Anytime there is an interaction between environment and people.
- Steps to Design and Implementing PES
    - What is it you're trying to protect?
    - Who owns the land tenure and resource rights?
    - Who are the stakeholders? Engage them.
    - What are the conditions today? Maintenance? Improvement of environmental service?
    - Do you know the communities you are working with? How do the current people make a living?
    - Evaluate and the cost is whatever the buyer and the provider can agree upon. May not be the actual project cost (could be more).
    - Breakdown:
        - Identify PES activities
        - Opportunity cost analysis
        - Negotiation
            - Make sure there is a level playing field between buyers and providers.
        - Agreement
            - Incentives might change overtime that reflect changing needs, must be flexible structured around reasonable time periods (3yrs or so)

        - Verification
            - Has the desired affect been achieved? Pay for performance.
        - Monitoring and Evaluation
            - Institutionalized enough so that all of these occurs intentionally
- Capacity Building
    - Governance
        - Transparency, representative decision making for all facets of the community (women, elderly, etc.)
    - Context specific dispute resolution mechanisms
        - Modification of agreement and discussion over time.
    - Benefits distribution system (BDS)
    - Land tenure
    - Negotiation skills
        - Level playing field
    - ES providers become managers, monitors, and sometimes enforcers
- Example
    - Beneficiaries: Water users, hospitals, schools
    - Providers: Two communities upstream
        - What is the current quality of the water?
        - Do you understand the communities well?
- Conclusion
    - Tool for operationalizing and financing conservation, community development and achieving environmental security
    - Egalitarian relationship between ES buyers and providers
        - Water is cleaner and thus needs less treatment and costs the water utility less to treat. Consequently more sustainable.
    - Advances other projects due to capacity building from these internal projects.

Globalization, Marine Pollution and Regional Environmental Security

Dr. Nalin Wikramanayake (*Open University Sri Lanka*)

- Definitions:
    - Marine and maritime
        - Sea and salt water
    - Pollution
        - Unwanted substance that will call in correlation of adverse change
    - Environmental security
        - Threats to good and services
        - MDG7 – environmental sustainability
- Scales of Marine Pollution
    - Is very diverse, based on sources of pollution and significant impacts occur at different scales
        - Scales: Local, Regional, Global
- Example: Mercury

  - Sources: natural and man-made (coal burning, mining, etc.)
  - Transport: Volatile metal with the possibility of atmospheric transport and global deposition
  - Converted to Methyl mercury in upper ocean
  - Biomagnified through food chain
    - Concentration up to 1000 to 100000 times than in sea water alone
- Current situation
  - Mercury levels have increased 3-5 times in atmosphere and 2ties in the upper ocean which means more will be enter the water
    - This then magnifies to the upper predators (i.e. tuna)
- Example: CO2
  - Increased CO2 created via burning fossil fuels and deforestation
  - Increased CO2 can cause imbalance of species in ecosystems, there will be an upper limit that organisms cannot clear CO2 from the atmosphere.
- Pollution from shipping
  - Oil spills: can start in one location and then spread widely.
    - Unfortunately these spills then travel to different regions that then affect the most vulnerable.
  - Ship waste: waste oil, sewage, solid waste, ballast water (introduction of foreign species)
- Regional Problem: Impact of Shipping Pollution
  - Toxicity mainly from lighter components that will gas off to the atmosphere, but will take to the shores. Any dispersants
  - Solid waste, i.e. plastics, are eaten by larger animals. Also due to UV radiation the plastics break down and breakdown into micro-particles that organisms do eat.
    - No idea about how these affect.
  - Ships breaking or “recycling” are done in countries that do not own or use the ships.
    - Releases pollutants: heavy metals, asbestos, PCBs, organics, and air pollution
    - Highly hazardous to workers
- Local Problem: Mt. Lavinia Beach
  - Sewage is disposed directly into the sea that is not deep enough and with tide shifts and wind the plume comes back to shore.
  - Affects fishery, tourism (blue flag beaches that are “certified” clean), and ecosystems.
- Framework
  - DPSIR, is a framework that evaluates cause and effect of environmental activities
    - Drivers: economic activities and social political decisions
      - For example the projected 2.5M tourisms by 2016 does not take into account how many prawns the will eat, etc.
    - Pressures:
      - Process affecting key ecosystems and social system function
    - State
      - Indicator functions and how they are affected
    - Impact
      - Effects on system characteristics

        - Response
            - How will the effects impact the communities?
- Simple Example (SEE PHOTO)
    - Increase tourism (driver), causes increased pollution.
    - Want: maintain/increase fish population
    - Can address it in many ways:
        - Can decrease pressures:
        - put more waste water treatment)
        - Decrease tourism
        - Approach from state end.
- Considerations:
    - Useful for information flows and formulation of responses. Will depend on the system that exists.
- Globalization:
    - Drivers and impacts widely separated: distance, borders, legal jurisdiction
    - Concentration of pollution: mercury is something that is dispersed, however other things such has shipping pollution is due to geography and since it such a concentrated shipping lane.
- Controls
    - MARPOL: Oil spills, hazardous cargo, sewage
    - London Dumping Convention
    - Basel Convention: prevents the trans-boundry transport of pollution
    - Difficulties in implementation and enforcement
        - Compensation for oil spills only if you can PROVE economic loss.
        - If you are a fisherman and your livelihood is impacted, need to prove that they have 3yrs of receipts. This has now been changed.
- Ship Breaking
    - Starting in the mid-90s in the US, then after the shift to building ships in Korea, etc. now there.
    - However it is very difficult to take a ship apart in the ocean. So the ship is grounded in locations that have a gentle shore slope and the available labor force break the ship down piece by piece.
    - Leadership by US Navy, all ships would break down their ships in the US. Original cost is $1,100 per ton. Today, the cost is negligible due to the increase cost of steel. This decision is only for US government ships and not for US flag ships.
        - Ship breaking yard in Brownsville, Texas. More controlled and a flourishing of recycling business due to careful governance 10-15yrs ago.
    - Due to US leadership, pressure has been applied to major ship owners via organizations (Greenpeace).
- Beyond Regulation
    - Concept of ethical consumption, related to “polluter/consumer pays”
    - User takes full responsibility for proper production and disposal
    - Ethnical tea: care for workers, living conditions, environmental conservation etc.
- Monitoring

    - Very difficult to monitor the ocean due to expense, safety, expanse, depth.
        - Consequently use the idea of "ships of opportunity," attaching instruments to ships that are already going about their regular routes.
        - Role of waste accounting
- Summary
    - Marine pollution affects environmental security
    - Globalization makes it difficult to identify the problem and actions against the problem
    - DPSIR framework can be useful for solution development
    - External/international pressures can be very effective at promoting change.
    - Everyone has a role in waste monitoring
- Recommendations
    - Set an example (i.e. US Navy, Sri Lanka Navy)
    - Go beyond regulations (i.e. proper disposal oil)
    - Develop partnerships (i.e. among the community and regulators)
    - Monitor and report
    - Be transparent

Coastal Zone Issues and Challenges in the Maldives

Mr. Ibrahim Naeem (*Ministry of Environment and Energy*)

- Geography: (See photo)
    - 1192 coral islands grouped into 20 administrative atolls
    - 198 inhabited islands
    - About 1M above sea level average elevation, extreme vulnerable due to sea rises and storm surges
    - 64% of inhabited islands face perennial beach erosion. Comparing photos from years ago the size of the islands have decreased by 10%.
        - There is also seasonal change of the island where sediment is removed and deposited on various sides of the island.
            - 40 to 50% of the islands move, where islands will relocate to completely different locations. Also is affected by monsoons.
        - Shape and location of the island affects
            - Circular island s are more unstable and change greatly, while elongate islands are more stable. Islands also located in the middle of the atoll are prone to the most amount of erosion.
    - Costal Issues
        - Conflicts of resource uses (i.e. fishers and tourism sectors), consequently the mega-fauna has gone down. The government has had to step in where the hotels are issued a particular day to go and the live-aboards on a different day.
        - Increasing wave energy. Change in frequency and intensity of storms, thought to be linked to global climate change.

        - Human activity impacts. Dredging and reclamation work has had devastation effects on the system. (i.e. Fuammulah has had many lanes dredged, which has caused increase wave energy and has sped up coastal erosion).
        - Reduction of reef productivity. Human pollution, coral/sand mining are also adding to the reduction of the reef.

- Mitigation
    - Hard engineering can be done, but if not done correctly it is both expensive and still can lead to some erosion (i.e. side of the island
    - Need to import foreign supplies for the walls, breakwaters, etc. which is very expensive
        - Maldives have had to remove structures to prevent further erosion in other areas of the
    - Soft engineering:
        - Continual pumping of sand back onto beach (i.e. resorts)
        - Planting trees, however these do not stop erosion immediately
        - Ultimately the cost comes out the same to hard engineering solutions but the aesthetics are better
- Other mitigations
    - Zoning and relocation, analysis of the rate of shoreline change and lifetime of the asset at risk. Evaluate the vulnerability of the asset and consider relocation away from the active shoreline.
    - Also need to consider the lessons learned based on research and past documentation (local knowledge on how particular beaches change seasonally).
        - Could possibly begin building houses on stilts
- Challenges
    - Insufficient data
    - Insufficient resources and equipment
    - Limited to technical and financial capacity to conduct regular monitoring and surveys
    - Distance between islands, transportation issues

Resource Protection Panel Session

Q (Arunabha): Keyvahn,

1. Used the word “agreements” use an example about how the “agreements” have provisions to increase over time.
   Q: During the analysis of the cost, the real cost is one price while the settlement can be far lower. As the agreement goes on, additional buyers would incrementally join in to lower the opportunity cost.
2. Dismissive of carbon, why can’t in the absence of a global market be addressed as well?
   Q: A lot discussion, not much action. The volume of carbon due to deforestation is immense. But need to start with a buyer, what price will they buy at? Carbon is a longer timeline issue, that

Q (Irahim):

1. What does offshore wind/tidal do the shore?
    a. Q: no comprehensive study or assessment of wind/tidal/soil data for renewables. Rely on Indian Ocean data sets.
2. If the erosion a regular occurrence what does it do to the fresh water lens?
    Q: It happens on occasion to particular islands; however the majority of water is covered by the remainder of the water. In the middle of the island the freshwater wells are normally alright. Due to the over-drafting of water most wells have been done, more so

Q: "Heavy" mercury pollution, is there any regional assessment of mercury done in this region?
A: Mercury in the sea water is actually very low, the data is almost 20years old now. The sampling procedures and protocols, equipment is different now. However, due to the gross balance there is an indication that there is a two fold increase. These are still very low numbers. Nonetheless, the impact of very small pollutants on human health are very difficult to assess. No need to panic however it would be interesting to do a survey in the Maldives, need a Maldivian picture (large consumption of tuna). Things we know:

- There is an increase in the level of mercury in the world's oceans
- Bioaccumulation can occur

Q (Dipak): I come to you and talk about payment for ES, infers that the "uplanders" should not develop so as to protect the "low lying." Is there any examples of the "low landers" doing anything ES wise for the "uplanders?"

- A: (Dr. Ghosh): I don't have an uplanders/lowlanders example but I do have an upstream/downstream example. Netherlands example, going to start paying for cleanup and putting in better processes. The point here is that it does not really matter where the money comes from, just that the flow of funds occur.
- A: (CPT Grelish): Paying for material
- A: (BG Mcleod): Government does play a big part in this as well, for example the EPA can apply external pressure for these upstream/downstream relationships.
- A (Dr. Sri Lanka): One way to convince sugar cane farmers to reduce fertilizer is these same people are the ones that

Q: (student) Everything is "tomorrow" tomorrow, what can we do today as students?

- A: (Keyvan) We do need leaders held accountable for.
- A: (Dr. Wikramanayake) Think globally, act locally. In your school think about creating programs that are focused on recycling, composting, etc.
- A: (Maldives dude): There are solar programs in the pipe. The best way to do action is to focus on specific small actions.
- A: (BG McLeod): The exercise this afternoon would show how various SMEs can come together. The issue here is getting the funding and money to provide for these programs. You need to learn the system and not focus on the symptoms.

Q: (Bangladesh) (Keyvan) Who will for pay for services? (Maldives Dude) Did you try to predict the erosion from year to year, have you considered satellite data?

A: PES is a market based mechanism and therefore is flawed since it is viewed through a human construct. Trying to make good use of everything we have in that given market. The biggest issues is that the minimum flow downstream must be 60%. The hydro people say 10%. A disconnect is here, there are irrigation harms downstream. This is not the cure-all, just a mechanism if used effectively, can result in sustainable solutions.
A: For the prediction we already use the satellite data and remote sensing already.

Q: (Hydro power developer background) What to have some predictability about what to expect for flow. We already account for taxes, fees, etc. Why do we have to add another payment to expenses such that there are no uncertainties?
A: Yes, human behavior is not predictable. The allocation of revenue is made at the top level (gov't official); these funds could be distributed to PES funds for reinvestment into the community. This reinvestment is largely not done currently.
A: Think of it in terms of risk reduction. How do you know that someone upstream isn't going to clear the entire forest above, you do not own the catchment above. This is one way to solidify and limit your levels of risk.

MALDIVES DAY 4 (JUNE 5th, 2014) - Energy

Introduction to Energy Theme

Brigadier General Mark M. McLeod (*USPACOM*)

- How do you balance growth/population increase to energy supply?
- Prosperity and Environmental Security
    - Environment
    - Socioeconomics
- What is USPACOMs role in all of this?
    - USAF uses a lot of fuel. DoD is the largest single user of fossil fuels and quite possibly the world
    - Work is based on "setting the theatre"
        - Access to locations and agreements to establish infrastructure and diversity of sources and create opportunities to "pool" demand signals to energy providers.
- Moving to DLA-E in a few months.
- Solve availability of fuel and access.
    - DoD does not traditionally focus on fuel efficiency.
- USPACOM is not just about warfighting, there are competitions in resources with the 5 largest militaries in the PACOM AOR. There are also counter-drug trafficking, HA/DR responses, etc. that all rely on pre-established multi-national relationships.
    - Linking diverse groups together to meet the needs of growing populations.
- Energy availability, energy distribution, distributed energy production.
    - Biofuel farm subsidies to drive down feedstock prices.

Energy Implications for India's Maritime Domain

Cdr Neil Gadihoke (*Society for Policy Studies - India*)

- The very fact that these themes are being discussed is because of the explosion of human population.
    - Growth will continue for another century, then the last 1B will require more time due to the fact that (China/South Asia). Any stresses and strains that you see now are not likely to go away soon.
- India's Energy Dilemmas
    - Main source of electricity is coal and hydro, but is inefficient and the uncertainty of water supply to run the hydro.
- Power Deficit Coastal States
    - Particular locations are a hub for industry and are suffering due to the lack of stable power supply. The reason of this power deficit is because the grids are not connected, no additions to capacity, delays in environmental clearances, delays in creation of transmission and distribution infrastructure. Corruption issues also plague the system.
- Promise of alternative energy
    - Ocean Energy
        - There is sea on three sides of India, thus ocean energy are viable
            - Tidal energy

        - Uses differences in height difference between high/low tides
      - Wave energy
      - OTEC
    - There is a potential of 7000MW using tidal energy and only exists in three locations that require a specific amount tidal delta to be efficient and cost effective.
  - Offshore wind
    - Largest wind farm is in-land and along a few of the coasts. 16B$ and 200K jobs created.
    - Currently the prime minister in New Delhi is a driver of change and has focused on energy projects.
    - Offshore wind has more constant wind and is less obtrusive to the population.
    - Sustainable cost for wind?
      - 1979; 40 c/kwh → 2010; less than 5c/kwh
- Three main sources of transportation pollution are shipping, airlines, and ground transport. However, shipping air pollution is never considered. Out of sight out of mind. There is no check or monitoring of ships. Shipping constitutes for 4% of global emissions. Millions of fishing and trawling hours spent by variety of Indian fishing vessels registered/unregistered.

Electricity Supply Security through Regional Cooperation in South Asia

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Dr. Sandip Shah (*SN Power Holding*)

- Security is essential for growth, especially in South Asia.
- Europe's largest renewable company and only focus on Hydro and Wind
  - 56TWh created annually
- Hydro dams have been delivering energy for so many years that they are essentially "batteries" for the local communities.
- Flexible hydropower with more than 370 plants based all over the way, HQ in Norway.
- South Asia – Electricity Supply Security Situation
  - India
    - Focused on the Northern side, "chicken" neck area. And the possibility for setting up interconnection for transmission connections.
  - Macroeconomic parameters
    - Based on population growth and GDP, all 4 countries (Nepal, Indian, Bhutan, and Bangladesh) have a steady growth. However the growth in India is the highest.
    - The electricity demand growth rate are still not 1:1, but still high.
    - Primary Energy Demand
      - Firewood, fuel wood, other local supplies are used, but increased tendencies of coal, oil, hydro, etc. are occurring.
    - Electricity consumption (SEE PHOTO)
      - India 644 kWh/capita
    - Electricity Generation Mix

- In India the installed capacity is associated with coal, however hydro is around 23% of capacity.

- Electricity Demand Forecast
  - Hydro is a major growth focus with new capacity added every year. Bangladesh is focused on gas plants with imported power from India and Nepal.
  - India and Bangladesh will be energy deficient eventually.
    - During the dry seasons there is not enough water supply to provide power to the hydro plants.
    - There are still peak deficits of around 14%.
    - Seasonal imbalances
    - Long hours of blackouts and diesel spot generation
    - Need:
      - Privatization of generation, transmission and distribution with a transparent regulator regime is changing electricity market dynamics.
      - Electricity to be treated as a commodity.
  - Push to increase volume by placing more power on the electricity exchange.

- There are many different sources of energy however these are only concentrated in particular portions of the country that are not accessible to the rest of India.
  - Integration of electricity systems required to:
    - To achieve balanced electricity supply system with affordable cost of electricity with generation mix from various electricity supply sources.
    - Cost of unserved energy, climate change, safety in production are factors which are impacted the way the electricity supply industry will grow.
  - It is imperative that regional cooperation for electricity supply security is a must.

- Existing Arrangements (SEE PHOTO)
  - Various agreements between the four countries.
- Way Forward
  - Plan and build high voltage capacity lights in the “chicken” neck area with a regional perspective with sufficiency redundancy
  - Integrate and synchronize electricity grids of the countries through HV links
  - Set up regional power trade agreements that define: grid stability, load dispatch, open access on transmission lines, recognize importance of different sources of electricity.
  - Ensure market access.
    - Summary:
      - High capacity transmission infrastructure
      - Regional power pool
      - Remove trade barriers
      - Open access on transmission lines

Promoting Decentralized Renewable Energy

Dr. Arunabha Ghosh (*Council on Energy, Environment, and Water*)

- Energy access, resource security and sustainable business models
- CEEW: one of India's leading think-tanks
- Agenda
    - Four main issues: how does India's energy needs relates to the global climate
- Energy Consumption by Country
    - 7069kgoe and 13394 kwh (USA)
- Energy access remains a major development challenge
    - "energy ladder" when you are poor you use solid fuels, as you get more prosperous you move to liquid fuels, then gaseous fuels. Then finally you run an electrified system.
        - Normally countries aspire to this ladder.
    - In India for rural communities, as they get richer they still use solid fuels.
        - This suggest that there is a problem with supply of resources.
- Important numbers:
    - Up to 70 percentile with energy access
    - 30 poor paying this much more than the rich for energy
    - Need to electricity 750 households every hour to meet the 2025 goal.
- India
    - 5th largest producer of electricity (Industrial, domestic and commercial the largest sectors)
    - Agriculture sector is also steadily increasing.
    - Much of the energy is coming from coal.
    - Many of the primary sources are fossil fuels which makes these countries the largest
- South Asia is the largest demand areas. However is not just growth, it's also competition of these new growth sectors to existing consumption factors.
- Renewables have the ability to fill in the gaps of energy security.
    - India gets a lot of sun (greater than 300 days/yr). Also the price of renewable energy is decreasing.
- Decentralized Energy Advantages
    - What is the state of the art in the country for decentralized energy?
        - 250 companies in India that are focused on decentralized energy.
    - Business model (SEE PHOTO)
        - This means that is not just one answer to the problem of energy.
            - Either need to reduce risk
            - Reduce capital
            - Create long term contracts
- Hut Example
    - Solar panel on roof and rainwater collection. Reasons was because it replaced kerosene that would dirty his white shirts that required more costs for regularly cleaning.
- HVAC consumes 55% of total energy used
- Creating a network called CLEAN (SEE PHOTO)
- Summary:

  - Access
  - Efficiency
  - Externality (positive and negative)

The Australian Defence Energy Integration Framework

Ms. Jane Holloway (*Australian Department of Defence*)

- Context 1: Anthropocene
  - Human species has become so powerful that they have become more powerful than natural occurrences.
  - Biggest threat is the biodiversity loss.
- Context 3: warming climate is creating risk for the global economy and human existence.
- The cost of liquid fuels will go up as supply diminishes.
- Four key risks
  - Supply Chain
  - Sustainability of supply
  - Technology
  - Governments
- View energy as a capability enabling system not only a burden.
- Minimize demand
  - Use training and education to increase awareness, "energy" credits to units
  - Incorporate energy considerations
- Enhance Reliability of Supply
  - Use scenarios and modeling to evaluate supply during operations, logistics tail.
  - Estimate gaps for fuel times and resupply.
- Strength Resilience
  - Identify and address vulnerabilities to energy supplies
  - Mitigate impacts from disruptions in energy supplies to critical assets.

- Approach 1: Triple Loop Learning (SEE PHOTO)
- Approach 2: Systemic Action Research (SEE PHOTO)

Energy Panel Session

- Q: Dr. Shah, interesting of putting India into the center of it. What about China and tying them into grid?
- A: Unfortunately the terrain is so rugged that laying a transmission line would be difficult and the nearest location in China that is suitable is too far away.

- Q (NICOLE): What type of off-shore wind are you considering? Have you had to de-conflict renewables?
  A: (Neal) its in 20-80m of water, not deep water (technically shallow offshore). Going to up to 300m of depth. The second question, the offshore farms are along the coast where it is sparsely populated.

A: (Dr. Ghosh) the challenges are even we have a long coast line there are conflicts with sea lanes, etc. Already an optimization problem, need to think hard about to optimally locate this technologies.

- Q (CHRIS): what about stored hydro when renewables are plentiful and demand is low?
- A (Dr. Shah): There is an element of coordination of generation of facilities. There is some degree of coordination between coal and hydro but not on the intermittences of the power sources.
- A (Dr. Ghosh) In India need to "book" demand the day before for electricity provision. Renewable energy producers must report what they are going to produce that they are going to drop into the grid. Need to develop more accurate modeling and the management of the grid is going to be more important.
- A (Neil): When the wind is 10-15mph the power production is ideal.

Q (Bruce): Given that energy is often in the wrong location. How do we make transmission more efficient?

A (Neil): Geopolitics plays a part in this, trans-boundary issues.

Q (Ari): Are the challenges more political than technical? Are there some tipping points? What might lead to the development of political will?

A (Neil): When life gets started disrupted politics will react. Bangladesh example. Political will is required.

A (Dr. Ghosh): No doubt there is technical challenge. In terms of bilateral discussions, need to change the narrative. Need to be bilateral transaction of not only money but also electricity. The balancing of the grid and economies of scale do NOT need to develop independently. None of these countries are rich by themselves; we do NOT what to have parallel grid systems.

Q (Neil) What about wind for Maldives?

- Not enough space, not enough wind pressure, not enough resources to invest into the system.
    - We are however looking into solar.

Q: State electricity boards in South Asia's defacto is scarcity creation. How would you address that?

A: Fairly steady supply as it is privately managed. Old social contract, when electricity was there you would run the pumps as long as possible. New social contract is a designated time for guaranteed power provision.

Q: The spot generation of smaller private communities, petroleum products.

A: State utility does not recognize the unserved costs of energy.

Q (Winnie Lau): Do we have the energy available to meet energy demand to close the gap for the next 10 years? As energy suppliers how do you evaluate energy efficiency?

A (Dr. Shah): 525MW of diesel generation in Nepal right now. They are already seeking out energy sources. Regarding the efficiency issues there are quite a few things happening, we have around 30% losses of which only 9% is technical losses the remainder is from T&D.

A (Dr. Ghosh): We need to scale up/down so that the gross consumption is much less. Access, efficiency, and externality that I had mentioned previously mentioned.

Q (Maldives): Have done some assessments in the past for wind?

A: Had pilot projects integrated into the existing grid but we have limited space.

Q: What happens when supply no longer meets demand?

A: We have not reached peak oil but we have reached "peak" oil production. Technology is being driven by consumer demand. However it also means that we are not transitioning into a clean energy future. Refer back to the "electricity ladder," and how an efficient grid is the ultimate form of fuels.