水与能源的关系: 可持续性与全球性挑战
The Water-Energy Nexus: Sustainability and Global Challenges
中美绿色合作伙伴会议
A US-China ECOPARTNERSHIPS Conference

PRESENTATION ABSTRACTS

US-CHINA ECOPARTNERSHIP PROGRAM: GOALS, ACCOMPLISHMENT, OUTLOOK

Author: **Erica Keen Thoma**s, Environment, Science, Technology and Health Counselor, U.S. Department of State, Beijing

Title: "**The U.S.-China EcoPartnership Program: Innovation and Cooperation to Solve Global Environmental Challenges"**

Abstract: The U.S.-China EcoPartnership Program has been in place for over five years. Throughout that history, organizations from the United States and China have cooperated to develop innovative solutions to concrete environmental problems. Erica Thomas will discuss the EcoPartnership Program from the perspective of the U.S. Government, including its history and purpose, as well as how it has expanded over the last five years. After highlighting some key accomplishments of the EcoPartnerships, Ms. Thomas will describe the current structure of the program and its future directions.

THE WATER-ENERGY NEXUS

Author: **Robert IVY,** Director, Department of Energy, U.S. Embassy - Beijing

Presentation Title: **GLOBAL ENERGY-WATER AND CLIMATE CHANGE CHALLENGES**

Abstract: Robert Ivy will discuss the U.S. Department of Energy's outlook on the energy-water and climate change challenges that the world faces today. His remarks will highlight the inextricable linkage between reliable, affordable energy, and abundant clean water. He will provide a broad overview of how the department and its national laboratories are analyzing these challenges, and how they are contributing to their solutions.

Robert IVY，美国能源部中国办公室主任

全球能源-水资源以及气候变化的挑战

Robert IVY 先生会讨论美国能源部对于全球当前所面临的能源-水资源问题以及气候变化挑战的观点。他将着重探讨可靠的、可以负担的能源与足够的清洁水之间密切的关系。他将介绍能源部及其国家实验室如何分析这些挑战以及如何解决这些问题。

Author: **Dongxiao ZHANG**, Professor and Dean, College of Engineering, Peking University

Presentation Title: **"Water and Shale Gas/Oil Development: A Balanced View towards Hydraulic Fracturing."**

Abstract: Shale oil and gas production has experienced a dramatically rapid growth in the United States over the past 10 years, which is primarily attributable to the application of horizontal drilling combined with hydraulic fracturing. Hydraulic fracturing involves injecting a large amount of fluid, composed of water, sand and chemical additives, into the deep underground. Currently, more than 90% shale wells are hydraulically fractured. The active hydraulic fracturing operations have aroused many public concerns about water resources, and even provoked protests against shale gas production, which led to prohibition and moratorium in some regions. Major concerns include the contamination to surface and underground water, and the aggravation of the local water supply that is already strained. However, whether these concerns are reasonable and will these fears become real? Upon critically examining such issues, it is found that some concerns of the public and the media are perceptive and not scientifically based. However, further study about fracturing mechanisms, new fracturing technologies with less water or even water-free, more advanced water treatment and recycling techniques, and more stringent regulation are required to ensure the safe, environmentally friendly and sustainable development of shale gas/oil resources.

水与页岩气/石油开发——水力压裂的一种平衡观点

张东晓
北京大学工学院

摘要：在过去十年中，页岩气与石油的生产经历了一场急剧的增长，这主要归功于水平钻孔技术与水力压裂技术的普遍应用。水力压裂是将由水、沙子和一些化学物质组成的流体大量地注入地下深处。目前，超过 90%的页岩气井利用的是水力压裂法。而广为应用的水力压裂作业已经引起了公众对于水资源的担忧，甚至激起了人们对于页岩气生产的抗议活动，使得部分地区不得不暂停或中断生产。人们的担忧主要包括水力压裂法开采页岩气对于地表水和地下水的污染，以及加剧本就紧张的水资源供应。然而，这些担忧是否合理？这些风险是否有真正发生？经过对于这些问题的深入研究，发现公众以及媒体的部分担忧是感性的，并无科学依据。不过，我们依然需要对压裂机制进行更深入的研究，开发使用更少的水甚至不需要水的新压裂技术、探索更先进的水处理及循环利用技术、以及采取更为严格的监管措施，来保证页岩气及石油资源的开采过程更安全、更环保、更具可持续性。

Author: **Vincent TIDWELL,** Distinguished Staff Member of the Technical Staff, Sandia National Laboratories

Presentation Title: **"Overview of the Energy-Water Nexus in the U.S."**

Abstract: Water and energy are inextricably linked. Water is used directly in hydroelectric power generation and is used extensively for thermoelectric power plant cooling and air emissions control. Water is also needed for energy-resource extraction, refining, and processing, as well as for energy resource transportation. In 2005 thermoelectric power production accounted for 49% of total withdrawals, making it the largest user of water in the U.S., while energy extraction/processing accounted for another 2% of withdrawals. Likewise, significant energy is expended to extract, convey, treat and deliver water and waste water. Recent studies suggest that over 12% of all energy produced in the U.S. is used to provide primary water services (including end use).

There are many factors likely to intensify this nexus. Chief among these is population growth and the related demands for water and energy. Emerging electric power generation and transportation fuel needs will require more water—the extent depending on the type and number of power plants built, cooling technologies used, air and carbon emission requirements, and the type and quantity of transportation fuels used. Expanding use of desalination and recycling of municipal wastewater is likewise increasing energy demands. This growth is occur at a time when the nation's fresh water supplies are seeing increasing stress from limitations of surface-water storage capacity, increasing depletion and degradation of ground water supplies, increasing demands for the use of surface water for in-stream ecological and environmental uses, and the uncertainty about the impact of climate variability on future water fresh surface and ground water resources. This presentation will explore the energy-water nexus in the U.S. with attention to both challenges and opportunities.

Vincent Tidwell，杰出研究员，Sandia 国家实验室

美国能源与水联系的概况

水与能源是紧密结合的。 水资源可以直接用于水力发电或火电厂冷却或废气排放控制。水资源在能源提取，精炼，处理以及能源传输中都发挥重要的作用。2005 年，火力发电厂消耗的水资源占了全部水资源消耗的 49%，成为全美水资源消耗最大的用户。而能源提取和处理占了 2%. 另外，洁净水以及废水提取，运输，处理，交付也消耗了大量的能量。近期的研究表明美国超过 12%的能源产量用于基本的水方面的服务（包括终端用户）。

有很多因素加强了这种联系。其中最主要的是人口增长以及其带来的对水资源和能源的需求。新出现的电力发电以及传输燃料需求造成对水资源更大的需求。这种需求增长的程度取决于新建的电厂的类型以及数量， 所用的冷却技术，废气已经二氧化碳排放的要求，以及所用运输燃料的类型及数量。扩大运用脱去水中的盐分或对废水的再利用也增加对能源的需求。增加脱盐或废水再利用的情况出现在国家的淡水供给出现紧张。出现紧张的原因可能由于有限的地表水储，地下水短缺或水质降低，用于生态环境保护的地表水需求增加，或对由气候变化对未来地表及地下淡水资源影响的不确定造成。本报告将讨论美国能源与水资源联系情况，包括其挑战以及机遇。

Author: **Tissa Illangasekare**, AMAX Distinguished Chair and Professor of Civil and Environmental Engineering, Colorado School of Mines

Co-Authors: **Mike Plampin, Ariel Esposito, Paul Schulte, and Kate Smits**

Presentation Title: **"Research for filling knowledge gaps in greenhouse gas migration in the subsurface affecting water and atmosphere."**

Abstract: The world is in a major transitional phase in its energy and chemical production, spurred by the dramatic growth in unconventional oil and gas extraction, particularly light oil and gas from shale reservoirs. From a climate change perspective, a debate is underway on the benefits of the transition from reduced burning of fossil fuels that load CO_2, a greenhouse gas to the atmosphere to potentially increased loading of methane, a more potent greenhouse gas from unconventional energy development.
Any analysis for comparison of benefits of this transition requires factoring in the environmental impacts on water and atmospheric systems. As burning of fossil fuel will continue during the transition and strategies of storage of CO2 in deep geologic formations will remain and option for reduction of atmospheric loading, the potential leakage impacts and risks of sequestrated CO_2 on shallow water sources and atmospheric loading have to be evaluated. Increased natural gas extraction and distribution that contribute to accidental releases will impact water and global climate. In this presentation, we will identify some of the knowledge gaps that exist in the understanding of CO_2 and methane migration in the subsurface and atmospheric loading and present results from experimental and modeling studies that are in progress in our research group to fill these knowledge gaps.

Tissa Illangasekare, AMAX Distinguished Chair and Professor of Civil and Environmental Engineering, Colorado School of Mines

Mike Plampin, Ariel Esposito, Paul Schulte, and Kate Smits

针对在温室气体在浅表流动对水及空气影响的研究

全球当前正处于其能源及化工生产的重要转型时期。非传统石油以及天然气提取的增长，特别是从页岩储集层提取轻油以及天然气促进了该转型。 从气候变化方面来说，从减少矿物燃料燃烧造成的二氧化碳温室气体排放到非传统能源提取可能产生的更强的温室气体甲烷的排放的转换带来的利益还在讨论之中。任何分析这种转型带来的影响都需要考虑对水以及空气造成的环境影响。由于在当前转型时期矿物燃料燃烧还在继续以及二氧化碳的存储于深层地址构造中仍然是减少其排放于空气中的一个方案，封存的二氧化碳可能泄露，其造成对浅层水资源以及大气造成的影响需要进行评估。增长的天然气提取及分配也可能造成泄露，将会对水资源以及全球气温造成影响。在本报告中，我们将讨论在当前在二氧化碳及甲烷转移至地球浅表及大气层中存在的知识空缺。我们还将讨论我们研究组在填补该空白中所做的实验及理论模型工作。

ADVANCES IN COLLABORATIVE GROUNDWATER RESEARCH

Author: **Richard HOOPER,** Ph.D., Director, Consortium of Universities for Advancement of Hydrological Sciences, Inc. (CUAHSI)

Presentation Title: **"A Technology for Global Data Sharing"**

Abstract: The CUAHSI Hydrologic Information System is a services-oriented architecture for data publication, discovery, and dissemination. It uses WaterML2 as its transmission language, which has been adopted as a global standard by the Open Geospatial Consortium and is under consideration by the World Meteorologic Organization. This system is part of the GEOSS AIP-6 discussions to develop global interchange standards for hydrologic data. CUAHSI currently hosts a catalog for universities and US government agency data holdings; other catalogs are being developed in the EU and New Zealand which are interoperable. The vision is to enable easy access to hydrologic data that can be merged with other data (e.g., remote sensing data, energy resource data) in a geospatial framework to permit a more complete understanding of water resource availability.

Richard HOOPER, 博士，全美高校水文研究联盟主席

演讲标题：促进全球数据共享的技术

摘要：CUAHSI 水文信息系统是一个面向服务的体系，用于数据发布，搜索，和传播。它利用 WaterML2 作为传输语言。WaterML2 已经被开放地理空间联盟采纳为国际标准。世界水文组织也在评估使用 WaterML2 作为其标准语言的可行性。这个系统是正在进行的 GEOSS AIP-6 讨论的一部分。这个讨论的目标是开发全球水文数据交换标准。CUAHSI 已经建立了一个供美国大学和联邦政府机关使用的目录区，供欧盟和新西兰使用的交互式目录区正在构建中。未来的规划是建立一个易于用户使用，易于和其它数据（如遥感数据，能源数据等）集成的地理空间平台，以促进更好更如入地研究水资源，利用水资源。

PRESENTATIONS BY ECOPARTNERS

CLEAN WATER: MANAGEMENT AND PROTECTION

ECOPARTNERSHIP ON GROUNDWATER MONITORING, PROTECTION AND TRAINING: *NYIT and PKU*

Author: **Chunmiao ZHENG,** Ph.D., Professor and Chair of Water Resources; Director, Center for Water Research, Peking University

Presentation Title: **A Global Perspective on Solving China's Groundwater Contamination**

Abstract: Groundwater provides about 20% of total water supplies for China, and provides 50-80% of water in water-scarce north and northwest regions of the country. However, groundwater has been subjected to rampant contamination due to rapid economic expansion and population growth over the last 30 years. In an effort to mitigate the situation, the Chinese government unveiled the "National groundwater pollution prevention and control plan" in 2011 with a mandate to assess and restore contaminated groundwater across China. However, even if the plan receives the pledged full allotment of 35 billion RMB (~5.6 billion USD) by 2020, it is likely only a fraction of what would be realistically needed, based on the authors' experiences. In a recent meeting of Chinese and international experts on China's groundwater challenges, the consensus emerged that developed countries have achieved great success in dealing with groundwater contamination and remediation over the last 30 years, but also left behind many legacies and lessons of failure that are invaluable for China. Since it is extremely difficult and expensive to clean up contaminated groundwater, prevention should be the primary focus, while remediation used sparingly with the cleanup targets carefully set. China must face up to enormous challenges in groundwater contamination and mobilize resources to tackle it immediately to mitigate public health risks and avoid future costs. It is recognized that while the traditional compartmentalized approach to deal with soil, groundwater, and surface water contaminations individually is relatively mature, the new challenge is a holistic systems approach, especially in places like China under rapid changes. It is imperative that China formulate and enforce strong groundwater pollution prevention and protection plans, backed by adequate financial resources, sufficient incentives not to pollute, and strong implementation of the existing regulations (Zheng and Liu, 2013, *Science*, v. 340).

解决中国地下水污染的全球视角

北京大学水资源研究中心
郑春苗

中国大约 20%的供水来自地下水，而在缺水的华北和西北地区，该比例更是高达 50%到 80%。但是，由于过去 30 年快速经济发展和人口增长，中国地下水已经受到严重的污染。为了扭转这一情况，中国政府制定和发布了《全国地下水污染防治规划（2011-2020）》，对全国地下水污染状况进行评估和防治。可以，即使这一规划的 350 亿元资金全部到位，根据作者的经验，它也只是实际所需经费的很小部分。在最近召开的一次有关解决中国地下水污染的国际研讨会上，与会国内外专家一致认为：西方发达国家在过去 30 多年进行的地下水污染研究中取得了丰硕的成果，同时也留下了许多地下水污染修复不成功的教训，值得中国借鉴；根据以往经验，地下水污染很难彻底清除，所以整体上 地下水污染应以防为主，以治为辅，对于修复目标和数据精度要求要谨慎考虑；中国目前面临严峻的地下水污染挑战，必须立即集中精力开展相关研究，为地下水污染防治工作提供理论基础，否则将造成巨大的经济损失和人民健康风险；将污染系统拆分研究以获取系统整

体特征的研究方法已经比较成熟，以整体的眼光研究复杂系统应成为下一阶段研究的重点，尤其对于快速变化环境下的中国。中国应制定和执行强有力的地下水污染防治和保护计划，投入足够的财政资源，实行有效的激励机制，并严格执行现有的法律法规（Zheng and Liu, 2013, *Science*, v. 340）。

Author: **Nada Marie ANID**, Ph.D., Dean, School of Engineering and Computing Sciences (SoECS), NYIT

Co-author: **Marta Panero, Ph.D.,** Director, Strategic Partnerships and Adjunct Professor, SoECS, NYIT

Title: "**Collaborative Approach to Promoting Groundwater Monitoring, Protection and Training"**

Abstract: This presentation will describe the collaboration "EcoPartnership on Groundwater Monitoring, Protection and Training" led by New York Institute of Technology and Peking University in partnership with Wuhan University's International School of Software, the American Institute of Chemical Engineers (AIChE) and its International Society for Water Solutions (ISWS), and HDR, a global firm providing environmental engineering and other services. Our EcoPartnership seeks to promote "Clean Water" through innovative models and technologies for the effective detection, protection, and monitoring of groundwater in China and the United States. These range from an integrated, web-based tool being developed by NYIT at its Green Technologies Laboratory (as part of the Entrepreneurship and Technology Innovation Center); to a remote telemetry framework to collect and analyze groundwater data from wells that is being introduced by Wuhan University and HDR/HydroQual; as well as a groundwater transport simulation system developed at PKU's Center for Water Research, and related training by AIChE. The EcoPartnership members also plan to conduct community outreach, training and education to broadly promote the protection and conservation of water resources.

多方合作促进地下水监测、保护和培训

作者：Nada Marie ANID 博士，纽约理工学院工程与计算科学学院院长
其他作者：Marta Panero 博士，纽约理工学院

摘要：本报告将详细阐述由纽约理工学院、北京大学、武汉大学国际软件学院、美国化学工程师协会及其水解决方案国际协会和提供环境工程及其他服务的跨国企业 HDR 公司共同参与的"地下水监测、保护和培训"绿色合作伙伴。
这项绿色合作伙伴计划旨在通过创新模型与技术来更高效地探测、保护和监测中美两国的地下水，最终推动"清洁水"进程。这其中包括由纽约理工学院绿色技术实验室（为创业

与创新技术中心的一部分）研发的一个基于网络的集成工具，由武汉大学和 HDR 公司联合开发的可用来收集分析井中地下水数据的远程遥测框架，和由北京大学水资源研究中心开发、美国化学工程师协会负责培训的地下水迁移模拟系统。绿色合作伙伴成员还计划通过开展社区外延、培训以及教育的方式来宣传水资源的保护和节节约。

Authors: **Darlene SCHUSTER,** Executive Director, International Society for Water Solutions, American Institute of Chemical Engineers (AIChE), and **Danny Reible, Ph.D.,** PE, BCEE NAE, Donovan Maddox Distinguished Engineering Chair, Texas Tech University

Presentation Title: **AIChE International Society for Water Solutions: Research and Technology Development and Filling Gaps in Technology Transfer and Education**

Abstract: Research and development in water technologies for clean water continues throughout the world, and the coordination of the research is a key component to implementation of the technologies. The International Society for Water Solutions, an AIChE Technological Community, aims to help advance the field of clean water technologies and to identify needed research and education. The ISWS network of members and supporting industries will foster relations for communication and coordination in their research and interdisciplinary projects that cross disciplinary, organizational, geographic and international boundaries. Research Gaps and efforts to fulfill will be discussed along with models for training that have been implemented by other AIChE sister technological communities. For example, the AIchE Columbia University model for coordination on education, coordination and training on the topic of carbon capture utilization and storage.

Darlene SCHUSTER 执行董事，国际水资源协会，美国化学工程师学会（AIChE）和 Danny Reible，PhD，PE，BCEE NAE，Donovan Maddox 杰出工程主席，美国德州理工大学

标题：AIChE 国际水资源协会：科研与技术开发，以及填补在技术转让和教育方向的空白

现阶段世界各地都致力于对清洁水资源的研究。在这个方向的研究需要不同领域的合作。国际水资源协会是美国化学工程师学会旗下的技术组织，其宗旨在推动清洁水新技术，规划科研和教育的新方向。 由其会员以及相关产业组成的 ISWS 网络旨在促进跨学科项目，并提供国际间，组织以及不同地域间的交流于合作。该组织提供与其它 AICHE 技术组织的合作并对科研领域及教育模式给于反馈以及提供现行的可行实例。例如 AICHE 哥伦比亚大学对于碳捕获，及对其的利用与储存的教学。

ECOPARTNERSHIP FOR WETLANDS AND ECODEVELOPMENT: *Tulane U. and East China Normal U.*

Author: **S. T. Hsieh,** Professor, Payson Center/Tulane University

Presentation Title: **"Evolution of our EcoPartnership: Past, Present and Future"**

Abstract: The US-China EcoPartnership for Wetland Research between Tulane University (New Orleans, LA, USA) and East China Normal University (ECNU, Shanghai, China) was one of the original EcoPartnerships established in 2008. With the guidance/leadership from the US and China Secretariats, respectively and the joint support of our home institutions (Tulane and ECNU) we have maintained our original commitments and establish a unique bi-national team of professionals. Recently, after consultations with our leaderships, we have transformed our EcoPartnership form research to include Eco-Development. We also plan to establish an NGO tentatively titled "International Innovation Center for Eco-Development" focus on clean water, clean air and clean energy. We will present our plan and propose to establish a partnership among all EcoPartnerships.

我们绿色合作伙伴的发展：过去，现在和未来

S. T. Hsieh **教授，杜兰大学佩森中心**

华东师范大学（ECNU, 中国，上海）和杜兰大学（美国，路易斯安那州，新奥尔良）之间的中美绿色合作伙伴（湿地研究）是 2008 年最早建立的合作对子之一。在中美两国政府相关部门的指导下及两校的支持下我们在保持原先主旨前提下建立了一支双边专业队伍。最近，我们在与领导协商后把我们的绿色合作伙伴从基础研究发展为兼顾区域和全球绿色发展。我们计划建立一个聚焦于生态净水，汇碳洁气和清洁能源的名为“绿色发展国际创新中心（暂定）”的 NGO 组织。
我们将报告我们拟在所有绿色合作伙伴对子间建立合作伙伴的计划和打算。

Author: **Jian Jian LU**, Ph.D., Professor of Ecology, East China Normal University

Presentation Title: **“Optimization of ecosystem services for human welfare”**

Abstract: The cases from estuaries of Yangtze River and Pearl River will be discussed, including results showing that water purification, carbon sink, biodiversity and so on of ecosystem services could optimized for regional ecological development by ecological restoration engineering.

优化生态系统服务功能为人类造福

陆健健博士，生态学教授，华东师范大学

长江河口和珠江河口的研究案例说明生态系统的生态净水，汇碳洁气及生物多样性保育等服务功能在人类认识生态系统演变规律的前提下可用生态恢复工程的方式进行优化和强化从而为人类造福。我们将与参会者一起探讨这个问题。

Author: **Robert Tansey,** The Nature Conservancy

Presentation Title: **Eco Partnership on Great Rivers - The Nature Conservancy's Great Rivers Partnership and the Chinese Ministry of Agriculture' Yangtze River Fishery Administration**

The Eco Partnership led by The Nature Conservancy and the Chinese Ministry of Agriculture addresses water issues from the standpoint of fisheries sustainability. The Ecopartners apply an environmental flows concept to develop a model for the Yangtze River. More recently the partnership is working on "Securing Water" approaches with potential broad applicability to China, drawing on TNC's worldwide experiences. Finally, our own EcoPartnership relationship has led to offer from the Chinese side to assist with U.S. invasive species/Asian Carp challenges as well as invitation to cooperate on marine front, i.e. for healthy oceans and sustainable fisheries.

江河生态合作伙伴

美国大自然保护协会的江河伙伴关系和中国农业部的长江渔业管理局

由美国大自然保护协会和中国农业部的长江渔业管理局缔结这个绿色伙伴关系将研究从渔业可持续发展方面考虑的水资源方面的因素。这个绿色合作伙伴关系将运用环境流动的概念来开发长江的模型。当前，这个绿色合作伙伴关系正在运用 TNC 的全球经验研究可能在中国有广泛用途的获取水资源的方法。最后，这个绿色合作伙伴关系将从中国方面协助美国面临的入侵品种 / 亚洲鲤鱼的挑战，以及在海洋方面的合作，例如健康的海洋生态和可持续的渔业。

ENERGY EFFICIENCY AND RENEWABLE TECHNOLOGIES

ECO PARTNERSHIP ON ENERGY EFFICIENCY: *Natural Resources Defense Council & Beijing Energy Conservation and Environmental Protection Center*

Authors: **Mona YEW,** Deputy Director, NRDC, China, and **Zhiyun ZHAO**, Director, Power Demand Side Management, BEEC

Presentation Title: "**DEMAND SIDE MANAGEMENT (DSM), A COST-EFFECTIVE WAY TO POWER BEIJING**"

Abstract: As the capital of China, reliable power supply in Beijing is of paramount importance. At the same time, Beijing relies heavily on imported electricity. The continued growth in Beijing has led to increasing demand for peak power and a widening differential between peak and off-peak load. International experiences have shown demand side management (DSM) to be one of the most cost effective means for meeting load growth and addressing peak constraints. Beijing

has initiated a number of DSM and energy savings projects and was selected in 2012 as one of four pilot cities in China with the purpose of demonstrating innovative DSM programs that can be replicated across China. The Natural Resources Defense Council (NRDC) and the Beijing Energy Conservation and Environmental Protection Center (BEEC) have formed an EcoPartnership to help Beijing build a successful and replicable DSM city pilot through results-oriented collaboration which includes policy research, technical support, program design and implementation, and capacity building. The partnership objective is to help Beijing achieve its 800 MW peak load reduction targets by using DSM as a reliable and sustainable power resource.

题目：电力需求侧管理（DSM），以最成本有效的方式满足北京电力需求

作者：游梦娜，自然资源保护协会 中国项目 副主任

作为中国首都，北京电力可靠供应至关重要。北京在很大程度上依靠外购电力来满足本市需求。北京经济持续发展将进一步推高电力峰荷、加剧电力峰谷差。国际经验显示需求侧管理是解决负荷增加和峰荷约束问题的最成本有效的方式之一。北京已经启动一系列的电力需求侧管理和能效项目，并于 2012 年入选国家电力需求侧管理综合试点工作的首批四个试点城市之一。综合试点城市的目的是示范创新型的电力需求侧管理项目，并在全国范围内推广。
自然资源保护协会（NRDC）和北京节能环保中心（BEEC）于 2013 年加入绿色合作伙伴关系项目，通过在政策研究、技术支持、项目设计与实施、能力建设等方面的定向合作，最终帮助北京构建一个成功的、可复制的电力需求侧管理城市试点。合作伙伴关系目标是通过将电力需求侧管理作为一种可靠的、可持续的电力资源，帮助北京实现三年 80 万千万的负荷削减。

ECOPARTNERSHIP ON INNOVATIVE BIOGAS TECHNOLOGIES: *Stony Brook and Tongji Universities*

Authors: **Devinder MAHAJAN,** Ph.D., Professor and Co-Director, Chemical & Molecular Engineering, Materials Science & Engineering Department, SBU[1]; **Xiaoli CHAI,** Ph.D., Professor, Department of Environmental Engineering, Tongji University [2]

Presentation Title: **Development of Low-Carbon Technologies for Landfill Gas Usage***

Abstract: Carbon dioxide (CO_2) is the most discussed greenhouse gas (GHG), though methane (CH_4) is over 20 times more potent GHG than CO_2. Globally, 882 billion cubic meters (bcm) methane (CH_4) was released to the atmosphere in 2013 (about 27% of the annual global consumption), of which 30-90 bcm CH_4 or 105–315 million barrels of oil equivalent (mboe) was released from landfills alone (PNAS, Miller et al., 2013). China produced 352 million tonnes of municipal solid waste (MSW) in 2013, of which only about 50% was in managed landfills. If this number could be increased to 70%, landfill gas (LFG) equivalent to 40 –80 bcm CH_4 could be

generated and avoided from release to the atmosphere. In the Unites States, landfills are the third largest source of anthropogenic CH_4 and LFG represents 17.7% (103 million metric tonnes of carbon equivalent ($MMTCO_2e$)) of all U.S. methane emissions (U.S. EPA data). Waste buried in landfills remains a major threat to human health and environment and the necessity of managing methane emissions in the context of climate change is crucial. Unlike schemes for CO_2 management that are inherently expensive (carbon sequestration is a case in point), CH_4 can be harvested economically from various waste sources.

Since curbing emission from LFGs are of mutual interest to both the United States and China, the Stony Brook University-Tongji University joint project was one of the six selected in 2013 under the EcoPartnership** program. The project seeks to develop a suite of technologies to manage gases (CH_4, CO_2 and H_2S) emitted from landfills and turn it in to usable products, primarily power and transportation fuels. To that effect, three key goals are identified. 1) Develop a reliable landfill methane emissions flux model 2) Develop advanced biogas clean-up technologies that render biogas amenable to further conversion to pipeline quality methane and 3) Develop schemes for conversion of clean biogas in to transportation fuels. Transportation fuels of interest are methanol and dimethyl ether (DME), a diesel substitute. The work is in collaboration with the Town of Brookhaven who is providing the landfill site for technology demonstration and Oberon Fuels who has developed the biogas to DME technology. A specific focus is on transportation fuels as an alternative to power production. The project follows the public-private-partnership (P3) model as we develop modular plants for community-based fuel production. This model is ideal to be replicated throughout Asia and Africa as well and the effort will result in arresting fugitive GHG emissions.

[1]Materials Science & Engineering Department, Stony Brook University, Stony Brook, New York 11973 USA and Sustainable Energy Technologies Department, Brookhaven National Laboratory, New York 11973-5000, USA

[2]School of Environmental Science and Engineering, Tongji University, Shanghai 200092, China

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生态伙伴关系对创新的沼气技术：Stony Brook-同济大学

Devinder MAHAJAN， 博士 ， 教授及联席主任，化学与分子工程学院，材料科学与工程系， SBU
Xiaoli CHAI， 博士 ， 同济大学环境工程系教授

标题： 开发填埋气体利用的低碳科技*

二氧化碳（CO ₂)是最为关注的温室气体（GHG），然而甲烷（CH_4)是比二氧化碳强烈 20 多倍的温室气体。 2013 年在全球范围内有 8820 亿立方米甲烷（CH_4），释放到大气（约占年度全球消费量的 27%），其中 300-900 亿立方米，相当于 1.05-3.15 亿桶油当量

（mboe）， 是从填埋场释放出的（PNAS，Miller et al.，2013 年）。 中国在 2013 年产生了 3.52 亿公吨的都市固体废物（MSW），其中只有约 50%进入了管理堆填区。 如果这个数目可以增加至 70%，填埋气体（LFG）可折合生产 400 - 800 亿立方米甲烷并可避免其释放到大气。 在美国，垃圾填埋场是人为产生的甲烷的第三大来源，填埋气体代表所有美国的甲烷排放量（US EPA 数据）的 17.7%（1 亿 3 千万公吨碳当量（MMTCO $_2$ e））。 埋在堆填区内的废品仍然是一个对人类健康和环境的主要威胁，在气候变化背景下管理甲烷排放更是至关重要的。 相对于昂贵的 CO_2 管理计划（碳封存是一个很好的例子），CH_4 可以很经济地从各种废物来源收获。

遏制 LFGs 排放量对于美国和中国有相互的利益，Stony Brook-同济大学联合项目是生态伙伴关系**计划下于 2013 年选定的六个项目之一。 该项目旨在开发一套技术用来管理从填埋场排放出的气体（CH_4, CO_2 和 H_2S），并把它转化为可用产品，主要用于电力和运输燃料。 此项目的三个主旨目标为： 1）开发一个可靠的填埋场甲烷排放通量模型 2）开发先进的沼气净化技术，使沼气经得起进一步转化为管道的优质甲烷 3）开发清洁转化沼气为运输燃料的计划。 可以考虑的运输燃料包括甲醇和二甲醚（DME），一种柴油替代品。 这项工作是与 Brookhaven 市和 Oberon Fuels 公司一起合作。Brookhaven 会提供填埋场用于技术示范，Oberon Fuels 开发了沼气转化二甲醚的技术。 项目的重点是运输燃料，并以此来替代电力生产。 该项目遵循公私合作伙伴关系（P3）模式，建立以社区为基础的燃料生产模块化工厂。 这种模式适用于亚洲和非洲并容易进行复制。

[1] 材料科学与工程系，Stony Brook University, Stony Brook, New York 11973 USA 和可持续能源技术部，Brookhaven National Laboratory, New York 11973-5000, USA
[2] 环境科学与工程学院，同济大学，上海 200092，中国

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*该项目由美中生态伙伴关系计划， 美国国务院和国家发展和改革委员会（NDRC）管理。 会议旅程费用由美国国家自然科学基金会资助。

WATER/ENERGY INFORMATION SYSTEMS

ECOPARTNERSHIP ON CLEAN WATER – GROUNDWATER PROTECTION

Author: **Paul J. ANID,** Dr. Sc., Vice-President, HDR Inc., New Jersey, USA

Presentation Title: **"REAL-TIME MONITORING AND MODELING: BEYOND CALIBRATION AND VALIDATION"**

Abstract: Traditional model calibration and validation relied on data sets acquired under different spatial and temporal settings that the models attempt to reproduce *a posteriori* in order to prove model skills. With the advancement in real-time data acquisition systems, the integration of innovative forecast modeling of coastal processes and state of the art monitoring

approaches is gaining ground in evaluating the predictive model skills. This presentation focuses on data acquisition/assimilation in modeling framework, its limitations and challenges. Case studies will be presented on how real-time data acquisition systems feed an operational modeling framework under different environmental settings, how data QA/QC automation might limit or enhance assimilation and the "burden" of real-time technology in terms of maintenance and long-term longevity of multi-parameters monitoring programs.

作者：Paul J. ANID 博士，副总裁，HDR 公司，美国新泽西州。

演讲题目："实时监测和建模：超过校准和验证"

摘要：为了证明模型的技能，传统的模型校准和验证依赖于在不同的空间和时间采集的数据试图重现一个后验。随着实时数据采集系统的进步，创新的沿海流程的预测建模和先进的监测方法一起用于评估预测模型。该演讲将重点讨论数据采集/同化建模框架，它的局限性和挑战。有关实时数据采集系统如何在不同环境设置下提供数据给业务建模框架的案例和数据 QA / QC 自动化如何在多参数监测方案的维护和长期寿命上可能限制或增强同化和实时技术的"负担" 的案例也将会讨论。

Author: **Xiaohui CUI,** Ph.D., Dean, International School of Software, Wuhan University

Presentation Title: **SIMULATION MODEL RESEARCHING OF CLIMATE CHANGE AND WATER RESOURCES**

Abstract: Water resources distribution has a long-term relationship with climate activities. This study provides a framework that can systematically and quantitatively understand the impact of climate change on water resources and analyze key factors and forecast trends.
This research will develop a conceptual model of climate-based water resources variation as a function of push (repulsive) and pull (attractive) factors that operate in environmental systems. An initial computational model will be tested in the northwest region of China that is vulnerable to climate change. This research will also assemble the necessary multidisciplinary expertise in population, hydrologic modeling, spatial modeling & simulation, and natural resources to develop a much-needed capability for the analysis of geopolitical and security analysis.

气候变化对水资源的影响仿真模型研究

水资源的分布与气候的变迁存在长期的相互作用。本研究提供系统的和定量实验框架用来分析气候变化与水资源的关系，分析影响因素和变化趋势。本次研究将开发基于气候变化的水资源分布概念模型，实现各类因素的推（排斥）拉（吸引）因素的分析。初始化的计算模型将会以中国西北部这个气候变化反应剧烈的区域作为测试对象，同时收集有关人口、水文模型、空间建模与仿真和自然资源分布等多方面专业数据和知识，用于地缘政治和安全分析。