

STOCKHOLM ENVIRONMENT INSTITUTE U.S.

ANNUAL REPORT
2013





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INTRODUCTION

The Stockholm Environment Institute is an international not-for-profit research organization that has been engaged in environment and development issues at local, national, regional and global policy levels for more than 20 years. Our goal is to bring about change for sustainable development by bridging science and policy. We do this by conducting integrated analysis that supports decision-makers.

SEI's work is interdisciplinary in nature, drawing upon engineering, economics, ecology, ethics, operations research, international relations and software design. We work all around the world building capacity for integrated sustainability planning through training and collaboration on projects.

SEI is headquartered in Stockholm, Sweden, and has six additional centers around the world. SEI's U.S. Center, an independent 501c-(3) nonprofit corporation, is a research affiliate of Tufts University in Massachusetts and also has offices in Davis, California, and Seattle, Washington.

2013 OVERVIEW

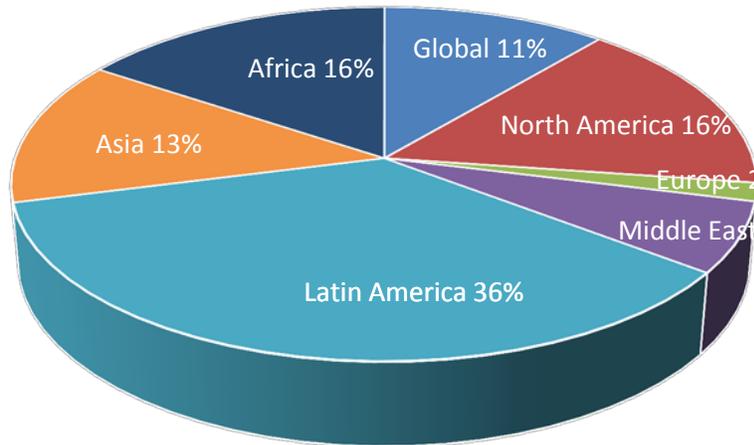
SEI-US completed its eighth year of operation in 2013, and continued to strengthen its core research efforts in water and energy resource management, climate mitigation policy, climate equity, and general sustainability issues. Research in climate economics was suspended in 2013 due to the departure of two senior staff who had focused primarily on that theme. In particular, our Latin-American focus continued to grow as climate change adaptation initiatives in Colombia (funded by USAID) and Ecuador (UK Department for International Development) proceeded at full effort, and new funding was obtained from USAID to promote water resource management efforts in Peru and Colombia. Support began also for seven Latin American countries in developing energy modeling capacity under the European Union-funded CLIMACAP program.

SEI-US FINANCES IN 2013

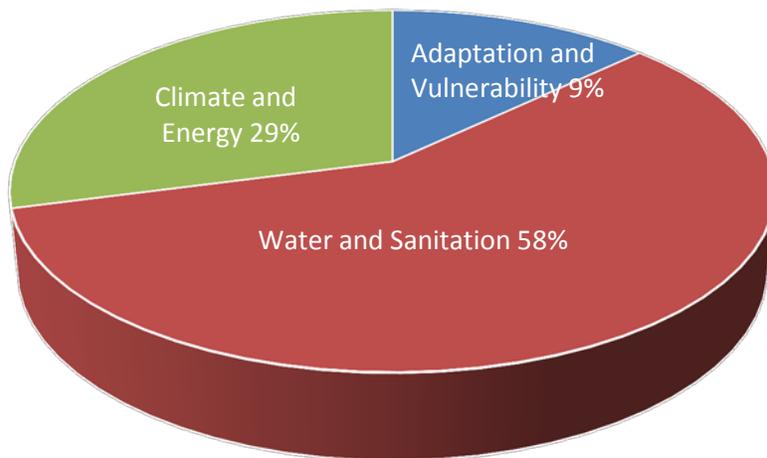
SEI-US ended the fiscal year with \$4,368,640 in revenue, approximately 3% greater than for fiscal 2012. SEI-US experienced a positive net change in assets of \$258,341 from its activity in 2013.

Breakdown of revenue by programmatic areas and geographic regions are provided graphically below. The ratio of available cash reserves to monthly expenses remained at a satisfactory value of approximately 5.0 during 2013, where it has been since the third quarter of 2009, indicating the continuation of a stable cash flow situation for the organization. SEI-US researchers continued to procure substantial (\$ 791,534) contract and grant awards through U.S. federal funding mechanisms. With regard to federal compliance and fiduciary responsibility, SEI-US successfully completed its fifth A-133 single audit as a component of its overall annual financial reporting.

Funding by Region



Funding by Program



RESEARCH PROGRAMS

Water Resources

Contact: David R. Purkey, david.purkey@sei-us.org
<http://sei-us.org/WaterResources>

In recent years, the issue of the long-range adequacy of fresh water resources has moved to center stage in international discussions of sustainable development. The call for the adoption of sustainable water strategies has become urgent as conflicts over the allocation of increasingly scarce water resources loom. Sustainable water management requires a systemic perspective that links water resources to requirements for irrigation, industry, human needs and ecosystems.



SEI-US has actively sought to heighten awareness of freshwater problems and to develop appropriate strategies for living within water budgets in a sustainable manner. The SEI-US Water Resources team advances integrated approaches to freshwater assessment and policy. The team works throughout the US, Central and South America and the Caribbean, the Middle East, Africa and Asia.

We work in five main areas:

- **Methods for Integrated Water Analysis:** SEI's WEAP (Water Evaluation And Planning) system, a transparent and user-friendly decision-support tool for engaging stakeholders, provides a unique framework for water assessment and planning.
- **Capacity Building:** WEAP is widely disseminated to water analysts throughout the world in both governmental and NGO settings, and SEI-US runs workshops on integrated water planning with WEAP as a conceptual framework and practical approach.
- **Modeling Climate Change Impacts on Water Resources:** SEI-US uses WEAP to quantify climate-change driven impacts to water resource allocation.
- **River Basin Assessments:** Working with local counterparts, SEI-US provides comprehensive assessments of water and environment in watersheds around the globe.
- **Global Water Futures:** SEI-US has been at the forefront of analyzing global freshwater conditions, preparing alternative water scenarios including developing and modeling agricultural adaptation strategies to climate change, and setting priorities for action.

Selected Projects in 2013

Enhancing the Resilience of Africa's Infrastructure

Staff: Huber-Lee, A.; Joyce, B.; Galaitsi, S.; Purkey, D.; RAND; University of Cape Town, Rhodes University; University of York; University of Massachusetts Amherst; 2iE; KTH; Nile Basin Initiative; Industrial Economics

Date: 2013-ongoing

Client/Funder: World Bank

Research Area(s): Water Resources; Energy Modeling

Description: This study seeks to address the implications of changes in future climate on the planned infrastructure investments in Africa. In particular, the study seeks to assess the vulnerability of water-

related infrastructure (i.e. hydropower, water storage, and irrigation) to climate and to estimate the costs of adaptation options designed to maximize the performance of this infrastructure in the face of climate uncertainty. The project focuses on the seven major river basins that have the greatest strategic significance for the continent in terms of hydropower and irrigation potential – i.e. Congo, Orange, Niger, Nile, Senegal, Volta, and Zambezi rivers – which account for the bulk of the region’s development potential, including some 200 GW of hydropower generation capacity. For each basin, a WEAP application is being developed that integrates climate-driven routines for estimating streamflow and agricultural water demands into a systems model that allows for the exploration of different management strategies and investments under a range of uncertainties. The Open Source Energy Modeling System (OSeMOSYS) will simulate the energy generation of the four power pools that overlap the seven river basins. The tool is being used to estimate the power generation from various sources given assumptions about future energy demands and hydropower capacity under different climate scenarios. While a rigorous water-energy nexus approach, which fully integrates the water and energy models, will not be feasible for this study, some linkages have been made between the water and energy tools. Specifically, water data from the seven basin WEAP analyses were fed into the OSeMOSYS energy models to describe (a) water availabilities for hydropower, (b) water pumping requirements for storage management, and (c) water available for irrigation related pumping requirements. With these initial constraints, the energy model runs and informs subsequent evaluation of adaptation options such that the analyses can achieve a first round robust scenario description and analysis.

Partnering for Adaptation and Resilience – Agua Project (PARA-Agua) in LAC

Staff: Purkey, D.; Escobar, M.; Forni, L.; Depsky, N.

Date: 2013-ongoing

Client/Funder: USAID

Research Area(s): Water Resources

In coordination with USAID bilateral programs and priorities, PARAAgua will work in target watersheds to undertake the following: 1) Create platforms for sustained dialogue and information sharing between the research community, policy makers, watershed stakeholders and the private sector to help mainstream the use of relevant scientific data; 2) Conduct stakeholder mapping for each watershed to determine key actors and relations, and facilitate participation women and disadvantaged groups; 3) Employ the Water Evaluation and Planning (WEAP) model to enable integrated assessment of climate change impacts on watershed dynamics within a single decision support framework; 4) Identify structural and non-structural adaptation options and facilitate access to finance to support implementation; and, 5) Replicate best practices and build capacity across the region through improved data sharing tools, twinning partnerships and other tools. SEI’s role is focused on strengthening planning systems that optimize water use over the whole length of watersheds in the context of climate change adaptation. We are currently implementing activities in the Chira-Piura watershed in Perú, and in the Chinchiná watershed in Colombia.

Integrating economics into water planning in Jordan

Staff: Huber-Lee, A.; Joyce, B.; Galaitsi, S.

Date: 2013-ongoing

Client/Funder: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Research Area(s): Water Resources

Description: SEI US is working with the Jordanian Ministry of Water and Irrigation (MWI) to develop an economic analysis tool that provides a comprehensive way to evaluate alternative infrastructure and water policies under a range of scenarios of climate, political change and economic development. The

tool (MYWAS) optimizes the benefits to be achieved from water subject to various water policy and management regimes and demonstrates the potential benefits of regional cooperation in managing water resources by reporting the differences in social welfare under different scenarios.

Water-Energy-Food Nexus

Staff: Huber-Lee, A.; Galaitsi, S.; SEI-International

Date: 2013-ongoing

Client/Funder: SEI-International

Research Area(s): Water Resources

Description: The Water-Energy-Food nexus is a framework under which natural resource scarcity and decisions about trade-offs are carefully evaluated and negotiated in order to make human development thrive, not just survive. Four connected but relatively distinct challenges relate to the governance of the Nexus: policy coherence, institutional coordination, integration, and planning. The starting point for the research questions related to governing the nexus is not that some super water-energy-food governance institution is needed, but rather that the optimal level of governance and jurisdictional fragmentation must be established in order to identify improved resource management strategies. This can be developed without compromising current functional governance components of individual sectors, but that will encourage cross-sectoral cooperation. We to find innovative ways for structuring and supporting decision making processes and explore ways to provide incentives and visualization techniques to compel managers across sectors to include broader considerations and information in their sectoral decisions. Building on SEI legacy tools (WEAP and LEAP), past Nexus projects and emerging opportunities in Africa, Asia, the Middle East and Latin America the Nexus initiative aims to develop a **Nexus toolkit** which enables a joint assessment of water supply, energy production and agricultural production and related environmental impacts. The toolkit allows regional, power pool, national and basin level planning exercises to identify and quantify externalities, understand risks and trade-offs and optimization of solutions. The Nexus toolkit is designed to follow a **joint learning** approach to tool and scenario development building on iterative interactions between stakeholders, SEI researchers and research partners. Expanding on a growing area of research on **robust decision making** we aim to guide decision makers towards “robust” options amid uncertainty.

Water-Energy implications under climate change for the Comahue Region in the Patagonia, Argentina

Staff: Forni, L.; Purkey, D.; Escobar, M.; Young, C.

Date: 2013-ongoing

Client/Funder: International Development Research Centre (IDRC) funded to Fundación Bariloche - Argentina

Description: SEI is collaborating with Fundación Bariloche in exploring the water and energy nexus components for future planning under climate and non-climate uncertainties for the Comahue region. Future climate change scenarios emerging from the IPCC indicate a potential increase in water stress in Comahue region in the Argentinean Patagonia. This region extends across multiple political jurisdictions and includes several water uses, such as: hydropower generation, water supply to support subsistence economies, large fruit production for local and export markets, residential water use, the oil industry (including conventional and unconventional reservoirs), and mining. While policy makers increasingly recognize the need for integrated water-energy-climate analyses, they lack the tools and capacity. This study aims to support policy makers via integrated tools for water-energy planning under climate and

non-climate uncertainties. The methodology is based on the dynamic exploration of the water-energy-climate linkages under future socio-economic and climate scenarios using the WEAP (Water Evaluation and Planning) and LEAP (Long-range Energy Alternatives Planning) models for long term policy support. Until now, a lack of suitable modeling tools has hindered efforts to explore the water energy nexus. In the context of climate change, the combination climate and non-climate related uncertainties such as population growth, socio-economic development and planning for energy access requires integrated analytical tools. The integration of WEAP and LEAP provides a technical view of resource use linkages and tradeoffs. Policy makers and stakeholders from both the water and energy sectors need to weigh the pros and cons, try to minimize negative outcomes, and formalize a decision based on those outcomes. The value of the integrated model and visualization tool is that it can help these actors understand the many implications and the exploration of the tradeoff landscape under a changing climate: 1) water availability to meet future growing demand for irrigated areas; 2) water supply for hydropower production; 3) increasing demand of water for mining and extraction of unconventional oil; 4) potential resource use conflicts and impacts on vulnerable populations.

Water Resource Planning through Climate Change Capacity Building in Colombia

Staff: Purkey, D.; Escobar, M.; Flores-Lopez, F.; Forni, L.; Sieber, J.; Universidad Tecnologica de Pereira; Universidad del Quindio; Fundacion CINARA

Date: 2012-ongoing

Client/Funder: USAID

Research Area(s): Water Resources

Description: This project seeks to develop capacity to achieve water management adaptation to climate change in the Eje Cafetero region of Colombia, in particular the Rio La Vieja watershed. Here, sensitive paramo ecosystems provide hydrologic services and functions by regulating the timing and supply of water to the demands of agriculture (coffee predominantly) and urban (mid-size) cities. Implementation of climate adaptation measures is confounded by an administrative structure requiring coordination at regional and national levels. Our research efforts will aim to complement current regional efforts to provide climate adaptation guidance, and will benefit substantially from local collaboration with the Universidad Tecnologica de Pereira, the Universidad del Quindio, and Fundacion CINARA.

Modeling the role of páramo in mountain hydrology under climate change

Staff: Purkey, D.; Escobar, M.; Flores-Lopez, F.; Davis, M.

Date: 2012-ongoing

Client/Funder: Secretario General de la Comunidad Andina

Research Area(s): Water Resources

Description: This project applies a WEAP model to the Piura páramo (moorland) in Peru as a pilot for modeling páramos in other Andean countries, aiming to enhance understanding of páramos' ecological functions in the context of mountain hydrology. Despite páramo ecosystems' importance as water sources, their hydrology has not been adequately studied. The meteorological and hydrological data for páramo areas are almost nonexistent, and scientific literature is scarce. A scientific publication was submitted presenting the paramo modeling methodologies developed through the study.

Urban Metabolic Mapping: Securing the Biophysical Foundation of Indian Cities

Staff: Mehta, V.; Kemp-Benedict, E.; SEI-Asia

Date: 2011-ongoing

Client/Funder: SEI-International

Research Area(s): Water Resources; Sustainable Futures

Description: The objective of this project is to develop a systems perspective of energy, water and material flows in Indian cities, and to provide information and deliberative modeling to the public via a geospatial web-based service. In collaboration with Indian Institute of Management and the Indian Institute of Science, Bangalore, the researchers seek to understand and communicate the socio-economic drivers of consumption in Indian cities.

Developing Climate Risk Management Strategies for Water Utilities

Staff: Purkey, D.; Fencel, A.; RAND Corporation; Hazen and Sawyer

Date: 2010-ongoing

Client/Funder: Water Research Foundation

Research Area(s): Water Resources

Description: Climate change adds a layer of complexity to the already substantial challenges facing water utility managers. As future conditions become increasingly uncertain, decision processes responding to these changes are necessarily evolving away from a deterministic prediction-based paradigm to one based on vulnerability identification and adaptation planning. SEI is developing a risk assessment and management framework for water utilities to help them learn about potential climate impacts and how these affect decision-making and planning. The framework will be piloted for the New York City water supply system and with the Colorado Springs Utilities.

Statewide Integrated Water and Energy Planning in California

Staff: Purkey, D.; Joyce, B.; Sieber, J.; Heaps, C.; National Center for Atmospheric Research; Pacific Gas and Electric Company; Lawrence Berkeley National Laboratory

Date: 2010-ongoing

Client/Funder: National Oceanic and Atmospheric Administration (NOAA); California Energy Commission (CEC)

Research Area(s): Water Resources; Energy Modeling

Description: This project continues to link SEI's Water Evaluation and Planning (WEAP) and Long-range Energy Alternatives Planning (LEAP) systems to build an integrated platform to explore water and energy interactions and feedbacks. In California, it is estimated that nearly 20% of all energy is associated with moving, lifting, treating, and using water. For this project, SEI has partnered with the state Department of Water Resources, which is responsible for guiding California's water future; the California Energy Commission, the coordinating agency to address climate change and reduce greenhouse emissions; and the Pacific Gas and Electric Company (PG&E), which provides natural gas and electric service to millions in northern and central California. We will link water management options, such as reuse, reservoir re-operation, demand-side management, land use changes, etc., as represented in the WEAP portion of the tool, to models of the electric utility serving the water utilities, as represented in LEAP. In addition to a new decision support tool, the results of this case study will be used to develop a final report on the Northern California's water future and its implications for energy demands.

Improving Water Productivity and Reducing Water-Related Conflict in the Andes

Staff: Purkey, D.; Escobar, M.; Universidad Nacional de Colombia Sede Palmira; World Wildlife Fund-Colombia; King's College-London

Date: 2010-ongoing

Client/Funder: Climate Program on Water and Food (CPWF), Consultative Group on International Agricultural Research (CGIAR)

Research Area(s): Water Resources

Description: SEI implemented a dynamic link between WEAP (developed by SEI) and the FIESTA (AguaAndes) model to provide information on water availability, demands, and management systems. The project is implemented in five watersheds in collaboration with local stakeholders actively participating in water resources negotiations.

Energy Modeling

Contact: Charlie Heaps, charlie.heaps@sei-us.org
<http://sei-us.org/EnergyModeling>

SEI's energy modeling activities are focused on the development, support and application of LEAP: the Long range Energy Alternatives Planning System, a software tool for energy policy analysis and climate change mitigation assessment used by thousands of organizations in more than 190 countries.

We work in three main areas:

- **LEAP Development and Support:** LEAP has been used at many different scales – from cities and states to national, regional, even global applications – for integrated resource planning and greenhouse gas mitigation assessments.
- **Scenario Studies:** In addition to developing LEAP and supporting LEAP users, we also apply LEAP in a wide variety of energy scenario studies – most recently in a global energy assessment.
- **Capacity and Community Building:** SEI is the founder and manager of COMMEND (COMMunity for ENergy environment & Development) an international initiative designed to foster a community among energy analysts working on energy for sustainable development.



Selected Projects in 2013

Revision and update of elements of Mexico's Low Emissions Development Strategy

Staff: Heaps, C.; Clark, V.

Date: 2012-ongoing

Client/Funder: World Wildlife Fund

Research Area(s): Energy Modeling; Climate Mitigation Policy

Description: SEI US is helping Mexico update its national emissions baseline and identify climate change mitigation opportunities. In recent years, the Mexican government has been involved in various efforts related to climate change and the reduction of greenhouse gas emissions, all with the broader intent of developing a national emissions reduction strategy. This project seeks to revise, update, and strengthen these previous efforts, and generate key elements for the formulation and implementation of a long-term national Low-Emissions Development Strategy using the LEAP system.

Statewide Integrated Water and Energy Planning in California

Staff: Purkey, D.; Joyce, B.; Sieber, J.; Heaps, C.; National Center for Atmospheric Research; Pacific Gas and Electric Company; Lawrence Berkeley National Laboratory

Date: 2010-ongoing

Client/Funder: National Oceanic and Atmospheric Administration (NOAA); California Energy Commission (CEC)

Research Area(s): Water Resources; Energy Modeling

Description: This project continues to link SEI's Water Evaluation and Planning (WEAP) and Long-range Energy Alternatives Planning (LEAP) systems to build an integrated platform to explore water and energy interactions and feedbacks. In California, it is estimated that nearly 20% of all energy is associated with moving, lifting, treating, and using water. For this project, SEI has partnered with the state

Department of Water Resources, which is responsible for guiding California's water future; the California Energy Commission, the coordinating agency to address climate change and reduce greenhouse emissions; and the Pacific Gas and Electric Company (PG&E), which provides natural gas and electric service to millions in northern and central California. We will link water management options, such as reuse, reservoir re-operation, demand-side management, land use changes, etc., as represented in the WEAP portion of the tool, to models of the electric utility serving the water utilities, as represented in LEAP. In addition to a new decision support tool, the results of this case study will be used to develop a final report on the Northern California's water future and its implications for energy demands.

Economics of Climate Change in Central and West Asia

Staff: Veysey, J.; Binnington, T.; Heaps, C.; Abt Associates

Date: 2013-2015

Client/Funder: Asian Development Bank

Research Area(s): Energy Modeling; Climate Mitigation Costs

Description: In this project, LEAP is used as the main scenario modeling tool to estimate the cost of climate change mitigation in the energy and transportation sectors of Azerbaijan, Kazakhstan, and Uzbekistan. This includes assessing the costs and benefits of mitigation options as well as determining their cost effectiveness. The consulting team uses LEAP to construct models for each country that describe the likely evolution of energy and fuel consumption and production in an economically-responsive way, and to estimate the emissions under a range of scenarios covering both baseline conditions as well as selected mitigation policies. Ultimately, the national models produced will be made available for use by any nationally-based organization, and used as training tools to build the capacity of energy and transportation analysts in each country.

Food/Energy/Environment Nexus in Ethiopia's Lake Tana Basin

Staff: Binnington, T.; Heaps, C.;

Date: 2013-2014

Client/Funder: SIDA/Stockholm Environment Institute

Research Area(s): Energy Modeling; Water Resource Modeling

Description: Ethiopia's Climate Resilient Green Economy (CRGE) plan lays the foundation for Ethiopia's green development through 2030. As part of ongoing work to develop and strengthen SEI's nexus toolkit, a regional LEAP model is being constructed to address the energy implications brought about by the CRGE, as well as by different water and land management practices modeled by WEAP. Special consideration was given to opportunities for household fuel switching, to respond to constraints imposed by a model of biomass growth in the region.

Strategies for Development of Green Energy Systems in Mongolia

Staff: von Hippel, D. (Senior Associate); Erickson, P.; Lazarus, M.; Tempest, K.

Date: 2013-ongoing

Client/Funder: Global Green Growth Institute (GGGI)

Research Areas: Climate Mitigation Policy; Energy Modelling

Description: This project evaluates and describes scenarios for the evolution of Mongolia's energy sector. The focus is on green energy systems that can lead to lower emissions of greenhouse gases in Mongolia, in addition to improving air quality, employment, and energy security. Four scenarios of energy supply and demand through 2035 are presented: *Reference*, *Recent Plans*, *Expanded Green*

Energy, and Shift in Energy Exports. These scenarios were developed with the input of, and with data collected by, an Advisory Committee from the Ministry of Energy and several other organization in Mongolia, as well as with inputs from a local consultant team. A bottom-up techno-economic analysis of energy and GHG-reduction scenarios was assembled using the Long-range Energy Alternatives Planning (LEAP) software.

Climate Mitigation Policy

Contact: Michael Lazarus, mlaz@sei-us.org
<http://sei-us.org/ClimateMitigation>

Avoiding dangerous climate change requires ambitious actions to deeply reduce greenhouse gas emissions at the international, national, and local community levels. At each of these levels, SEI-US informs, supports and advises decision-makers and civil society on possible pathways to an equitable, low-carbon future.

In addition to activities specifically related to energy modeling, climate economics, emissions trading, and equity, SEI-US:



- Provides analytical support and facilitation to regional and local policymakers and stakeholders in the development of climate action plans, in the design of emission trading systems, and in the establishment of technical capacity. For example, SEI-US has provided technical support to several U.S. states, including Washington and Massachusetts; to numerous developing countries, and to regional programs such as the Western Climate Initiative.
- Conducts low-carbon scenario studies that outline pathways to deep emission reductions, such as the recent Carbon Neutral Seattle and Europe's Share of the Climate Challenge studies.
- Develops methods for emissions accounting and assesses policies and measures such as domestic and international offset protocols (e.g. the Clean Development Mechanism), emissions benchmarking, and comprehensive emissions tracking frameworks that take both consumption and production into account.
- Develops tools to better assess the life cycle impact of energy projects (e.g. woody biomass energy).

Selected Projects in 2013

C40 Cities

Staff: Erickson, P.; Tempest, K.

Date: 2012-ongoing

Client/Funder: C40 Cities Climate Leadership Group

Research Areas: Climate Mitigation Policy

Description: SEI has an ongoing partnership with C40 to develop frameworks for estimating the GHG abatement potential of urban areas and urban policy. In 2012, we developed estimates of the greenhouse gas emissions reduction potential of C40 cities in the years 2020 and 2030; In 2013, we developed a typology of urban-scale GHG abatement policies and measures, and conducted an initial quantification of the global potential (this work was published a peer-reviewed journal article). In 2014 we are developing a global data set to support analysis for individual cities.

Strategies for Development of Green Energy Systems in Mongolia

Staff: von Hippel, D. (Senior Associate); Erickson, P.; Lazarus, M.; Tempest, K.

Date: 2013-ongoing

Client/Funder: Global Green Growth Institute (GGGI)

Research Areas: Climate Mitigation Policy; Energy Modelling

Description: This project evaluates and describes scenarios for the evolution of Mongolia's energy sector. The focus is on green energy systems that can lead to lower emissions of greenhouse gases in Mongolia, in addition to improving air quality, employment, and energy security. Four scenarios of energy supply and demand through 2035 are presented: *Reference*, *Recent Plans*, *Expanded Green Energy*, and *Shift in Energy Exports*. These scenarios were developed with the input of, and with data collected by, an Advisory Committee from the Ministry of Energy and several other organization in Mongolia, as well as with inputs from a local consultant team. A bottom-up techno-economic analysis of energy and GHG-reduction scenarios was assembled using the Long-range Energy Alternatives Planning (LEAP) software.

Low carbon cities

Staff: Erickson, P.; Tempest, K.

Date: 2013-ongoing

Client/Funder: SEI-International

Research Areas: Climate Mitigation Policy

Description: SEI is developing a model for cities around the world to use in assessing alternative scenarios of development and GHG emissions. Work involves developing a set of region-specific default data for cities to apply, developing a city-focused interface for SEI's LEAP software, and conducting pilot analyses with individual cities.

New fossil fuel economy - Risks of and responses to the new fossil fuel economy

Staff: Lazarus, M.; Erickson, P; Kartha, S.; Tempest, K; SEI-International

Date: 2013-ongoing

Client/Funder: SEI-International

Research Areas: Climate Mitigation Policy

Description: This project provides analysis on the climate and other social and environmental risks of developing new fossil fuel supply and delivery infrastructure. Key objectives include: cataloging and assessing risks of unconventional gas and oil development, as well as new coal trade infrastructure, with respect to greenhouse emissions and local livelihoods in developing countries; identifying "hot spots" or "convergence zones" where countries pursuing green growth initiatives may also face decisions on whether or how to develop sizeable new fossil fuel resources; exploring potential policy and other responses that various stakeholders, including policy-makers, NGOs, and multilateral/bilateral institutions can take to minimize these risks associated with potential fossil resource development, and provide resources for stakeholders to respond to these risks. Possible case studies include oil shale developments in North Africa, North America (a Keystone XL Pipeline analysis has been published), and the risks and the risks of developing new coal resources and transportation routes in the Pacific and North Asia region.

Boulder climate commitment

Staff: Erickson, P.; Tempest, K.

Date: 2013

Client/Funder: City of Boulder

Research Areas: Climate Mitigation Policy

Description: Provided guidance and inputs for various steps of the development of climate goals for the City of Boulder, Colorado. Tasks included benchmarking of carbon reduction goals, strategies, and outcomes from a group of global cities with common characteristics to Boulder, and providing feedback on proposed carbon reduction goal and strategy outputs.

2012 Seattle Community Greenhouse Gas Emissions Inventory

Staff: Erickson, P.; Tempest, K.

Date: 2013-ongoing

Client/Funder: Seattle Office of Sustainability and Environment

Research Areas: Climate Mitigation Policy

Description: This project completed the 2012 Seattle Community Greenhouse Gas Emissions Inventory, the findings of which were made public in April 2014. The 2012 Inventory included a review of Seattle’s community emissions in 1990, 2005, 2008, and 2012. It adopted two main emissions perspectives, “core” emissions over which the city has the greatest influence, and “expanded” emissions with additional sources. Information from the inventory will be used to both monitor city performance against ambitious emissions reduction goals and to inform ongoing climate action planning.

Towards a Common Accounting Framework for pledges under the UNFCCC

Staff: Lazarus, M.; Kollmuss, A.; Schneider, L.

Date: 2013-ongoing

Client/Funder: Swiss Federal Office for the Environment

Research Areas: Climate Mitigation Policy; Climate Economics

Description: Under the UNFCCC, many countries have pledged mitigation objectives for the year 2020, ranging from quantified economy -wide targets to
reduction targets compared to a baseline or sectoral targets. While this can be viewed as a positive development emerging from COP15 (Copenhagen), Parties have yet to agree on common accounting rules or to establish a process sufficient to demonstrate that these pledges have been met. For this project, we researched, published, and presented a number of reports – on achieving a net mitigation benefit, on avoiding double counting, and on accounting rules generally -- that could assist in the development of a common accounting framework (CAF) that would apply across all pledges, especially with relation to the treatment of market -based units

New climate economy

Staff: Lazarus, M.; Erickson, P; Tempest, K.; Lee, C.

Date: 2013-ongoing

Client/Funder: The New Climate Economy: The Global Commission on the Economy and Climate

Research Areas: Climate Mitigation Policy; Climate Economics

Description: Served as research partners for a major New Climate Economy project that seeks to address economic decision-maker and address how economic and social goals can be met in concert with reducing the risk of dangerous climate change. As research partners, engaged on analysis of natural gas as a bridge, the potential for emissions reductions from global cities, and the resource potential and cost projections of renewable power.

Additionality of CDM**Staff:** Lazarus, M., P. Erickson, C.M. Lee**Date:** 2013-ongoing**Client/Funder:** DG Clima**Research Areas:** Climate Mitigation Policy

Description: In collaboration with colleagues at the Öko-Institut and INFRAS, SEI is contributing to an evaluation of current tools and alternatives for additionality assessment under the CDM. The study employs a variety of approaches to evaluate to what extent the CDM meet its objective to deliver “real, measurable and additional” emission reductions. The research evaluates three main areas: general CDM rules, specific project types, and innovative approaches towards baseline setting and additionality assessment.

Technical Working Paper on GHG Emissions, Scenarios and Mitigation Potentials in the Energy and Transport Sectors**Staff:** von Hippel, D. (Senior Associate); Tempest, K.; Erickson, P.**Date:** 2013-ongoing**Client/Funder:** Asian Development Bank (through NIRAS A/S and D. von Hippel)**Research Areas:** Climate Mitigation Policy

Description: This project included the preparation of a LEAP (Long-range Energy Alternatives Planning) energy/environment/economic model for the country of Vietnam and for three provinces in Vietnam. Each model included a business-as-usual scenario (2012 through 2030) of energy supply and demand development, plus a mitigation scenario modeling the implementation of over 30 greenhouse gas emissions mitigation options throughout the Vietnamese economy. The two scenarios, and their greenhouse gas emissions and cost implications were described in a Final Report that is complete and is expected to be released soon. The Final Report also includes a description of suggested actions that Vietnam and its provinces might undertake to reduce national and provincial greenhouse gas emissions, while advancing development and building a "greener" economy.

Fixing Critical Accounting Gaps in Bioenergy**Staff:** Lazarus, M.; Lee, C.; Heaps, C.; Clark, V.**Date:** 2012-ongoing**Client/Funder:** SEI-International**Research Area(s):** Climate Mitigation Policy; Energy Modeling

Description: Current bioenergy accounting approaches have led to a ‘critical climate accounting error’ in the treatment of greenhouse gas emissions from biomass combustion. We are conducting research to identify suitable analytical approaches to better account for bioenergy impacts in GHG mitigation analyses, and to incorporate one or more approaches into the LEAP energy planning software.

Emissions Trading & Offsets

Contact: Michael Lazarus, mlaz@sei-us.org
<http://sei-us.org/EmissionsTrading>

Avoiding dangerous climate change requires ambitious actions to deeply reduce greenhouse gas emissions at the international, national, and local community levels. At each of these levels, SEI-US informs, supports and advises decision-makers and civil society on possible pathways to an equitable, low-carbon future.

In addition to climate mitigation activities specifically related to energy modeling, climate economics, emissions trading, and equity, SEI-US:



- Provides analytical support and facilitation to regional and local policymakers and stakeholders in the development of climate action plans, in the design of emission trading systems, and in the establishment of technical capacity. For example, SEI-US has provided technical support to several U.S. states, including Washington and Massachusetts; to numerous developing countries, and to regional programs such as the Western Climate Initiative.
- Conducts low-carbon scenario studies that outline pathways to deep emission reductions, such as the recent Carbon Neutral Seattle and Europe's Share of the Climate Challenge studies.
- Develops methods for emissions accounting and assesses policies and measures such as domestic and international offset protocols (e.g. the Clean Development Mechanism), emissions benchmarking, and comprehensive emissions tracking frameworks that take both consumption and production into account.
- Develops tools to better assess the life cycle impact of energy projects (e.g. woody biomass energy).

Selected Projects in 2013

Options and Guidance for the Development of Baselines

Staff: Lazarus, M.

Date: 2012-ongoing

Client/Funder: World Bank / Partnership for Market Readiness

Research Areas: Climate Mitigation Policy; Climate Economics

Description: Emissions baselines are fundamental to market-based climate policy instruments, as well as to non-market-based ones such as results-based payments. For this project, SEI worked with various stakeholders and country representatives to co-author a technical document that offers options and guidance for the development of these baselines. Developed under the Partnership for Market Readiness (PMR), it is designed to support PMR Implementing Countries that are considering the establishment of new mechanisms. It may also assist other policy makers and policy analysts involved in mechanism design or review, practitioners developing baseline methodologies, and actors implementing mitigation initiatives whose impact needs to be quantified.

Can carbon revenues help transform household energy markets? A scoping study with cookstove programs in India and Kenya

Staff: Lee, C.M.; SEI-International

Date: 2013-ongoing

Client/Funder: GIZ

Research Areas: Climate Mitigation Policy; Climate Economics

Description: Carbon finance has emerged as an attractive option to help scale-up cookstove projects, but little research has been done on how well it meets the needs of these projects. To address this gap, SEI conducted a scoping study in India and Kenya to examine the growing role of carbon finance in cookstove projects, with a focus on how it might support market transformation. The authors conducted an in-depth review of the project design documents (PDDs) for 75 carbon-financed cookstove projects in India and Kenya. They also interviewed 49 stakeholders along the value chain, including cookstove project implementers (both carbon-financed and not), households, NGOs and cookstove and carbon market experts. The analysis presented in this report focuses on how carbon finance might help or hinder projects in meeting those challenges.

New climate economy

Staff: Lazarus, M.; Erickson, P; Tempest, K.; Lee, C.

Date: 2013-ongoing

Client/Funder: The New Climate Economy: The Global Commission on the Economy and Climate

Research Areas: Climate Mitigation Policy; Climate Economics

Description: Served as research partners for a major New Climate Economy project that seeks to address economic decision-maker and address how economic and social goals can be met in concert with reducing the risk of dangerous climate change. As research partners, engaged on analysis of natural gas as a bridge, the potential for emissions reductions from global cities, and the resource potential and cost projections of renewable power.

Climate Equity

Contact: Sivan Kartha, skartha@sei-us.org
<http://sei-us.org/ClimateEquity>

The emerging climate crisis must be seen against the backdrop of an ongoing development crisis. The scientific imperative of climate change requires extensive emissions reductions in all countries, but it is politically unrealistic and ethically unacceptable to expect those struggling against poverty to focus their limited resources on averting climate change. Developing countries must still transition toward a low-GHG development path, but the global consuming class – the industrialized world and elites within developing countries – must provide the financial and technological resources that will enable this transition.



A centerpiece of SEI's work in this field is the Greenhouse Development Rights (GDRs) Framework, developed by SEI and Ecoequity, which presents a burden-sharing framework based on a straightforward accounting of national responsibility and capacity that requires those who consume and emit more than a specified "development threshold" to carry the global cost of an emergency climate program. The GDRs framework could provide the basis of a solution to the burden-sharing problem at the heart of the climate negotiating impasse. It could enable a climate regime that ensures ambitious mitigation globally to avert a climate disaster, while safeguarding the right to development in the South.

In addition, SEI contributes to the global climate policy dialogue through research, analysis, and on-the-ground engagement with Parties and non-governmental organizations involved in the United Nations Framework Convention on Climate Change process.

Selected Projects in 2013

Developmental equity in an international climate regime: Analysis, practical paths and engagement

Staff: Kartha, S.; Kemp-Benedict, E.

Date: 2011-ongoing

Client/Funder: Sida

Description: This project is built on the notion that an equitable framework is a precondition for an effective climate regime. Without developmental justice, it will not be possible to win the earnest engagement of the developing world, which is necessary for a successful global response to the climate problem. This project will continue and extend the work of the ongoing Greenhouse Development Rights project. It aims to instill a perspective of developmental equity into the climate discourse and negotiations, by providing an appropriate framing and the necessary technical, analytical and political substantiation.

Contributions to the Intergovernmental Panel on Climate Change

Staff: Kartha, S.; Schipper, L.; Klein, R.J.T.

Date: 2013

Client/Funder: IPCC

Research Area(s): Climate Equity, Adaptation & Vulnerability

Description: This project is part of SEI's larger contribution to the *Fifth Assessment Report (AR5)* of the IPCC. Sivan Kartha is serving as Coordinating Lead Author of Chapter 4, "Sustainable Development and Equity", of Working Group III. He is also a coordinator of the Least Developed Country and Developing Country Contact Group, which was newly constituted at the spring 2012 Lead Authors Meeting, to help ensure that the AR5 is policy-relevant to developing country decision-makers. Lisa Schipper is Lead Author of Chapter 21, "Regional Context", of Working Group II. She was also a Lead Author of the IPCC *Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. The drafting of the AR5 began in spring 2011, and the report will be approved and issued at the end of 2014.

Greenhouse Developments Rights (GDRs)

Staff: Kartha, S.; Kemp-Benedict, E.; Athanasiou, T. (EcoEquity); Baer, P. (Georgia Institute of Technology)

Date: 2006-ongoing

Client/Funder: IPS (Sida), Mistra Foundation, Rockefeller Brothers Fund, International Center for Human Rights Policy

Description: The Greenhouse Development Rights (GDRs) Framework, developed by SEI and Ecoequity, presents a burden-sharing framework based on a straightforward accounting of national responsibility and capacity that requires those who consume and emit more to carry a larger share of the global cost of an emergency climate program. Relatively wealthy people who have produced higher levels of emissions can thereby protect the right to development of the world's poor. The GDRs framework could potentially be used to design a solution to the burden-sharing problem at the heart of the climate negotiating impasse. It could provide the basis for ambitious mitigation globally to avert a climate disaster, while safeguarding the right to development in the global South.

Sustainable Futures

Contact: Eric Kemp-Benedict, erickb@sei-us.org
<http://sei-us.org/SustainableFutures>

Investigating the potential for a sustainable future lies at the heart of all of SEI's work. This research area, however, takes a longer view, exploring different scenarios for development and building tools to help decision-makers and planners think about the future. This work falls into three broad categories:



- **Large-Scale and Long-Term Studies:** Development that is truly sustainable must take into account the larger-scale implications of development pathways, both in space and in time. How might a landscape change, for example, if biofuels production became a centerpiece of its economy? Or how might a river basin change over the coming decades if agricultural irrigation systems are widely adopted? By framing issues in this manner, SEI helps decision-makers the broader ramifications of their choices.
- **Exploring the Prospects For a Sustainability Transition:** The sustainability challenge is to achieve broadly shared prosperity indefinitely into the future while maintaining and enhancing the ecological functions that support people and other life. Meeting the challenge will require a transition from our current technological infrastructure and habits. In keeping with SEI's mission to bridge science and policy, SEI investigates technologically, environmentally, and socially feasible options to achieve this.
- **Tools and Techniques For Thinking About the Future:** Local environmental and political conditions, beliefs, preferences and histories are all crucial to the success of sustainability initiatives. Widely disseminated tools and techniques that can be used by many different groups and communities can play an essential role in achieving a sustainability transition. As SEI develops its own "futures toolkit", it shares it with others, so they can apply these tools in their own contexts.

Selected Projects in 2013

Inequality and Sustainability

Staff: Kemp-Benedict, E.; Kartha, S.; Stanton, E.A.; Fencel, A.; Olson, K.; Davis, M.; SEI-International

Date: 2011-ongoing

Client/Funder: SEI-International

Description: While a privileged few enjoy unprecedented levels of wealth, a large share of the global population still lacks access to basic resources. This project seeks to understand how different kinds of inequality – between individuals, groups, and countries – affect the prospects for long-term sustainability, and to apply that knowledge to practical, policy-relevant questions.

Urban Metabolic Mapping: Securing the Biophysical Foundation of Indian Cities

Staff: Mehta, V.; Kemp-Benedict, E.; SEI-Asia

Date: 2011-ongoing

Client/Funder: SEI-International

Research Area(s): Water Resources; Sustainable Futures

Description: The objective of this project is to develop a systems perspective of energy, water and material flows in Indian cities, and to provide information and deliberative modeling to the public via a geospatial web-based service. In collaboration with Indian Institute of Management and the Indian Institute of Science, Bangalore, the researchers seek to understand and communicate the socio-economic drivers of consumption in Indian cities.

Technical Support for the Cross-Media Electronic Reporting Regulation (CROMERR)

Staff: Veysey, J.

Date: 2013-ongoing

Client/Funder: U.S. Environmental Protection Agency (USEPA)

Research Area(s): Other

Description: In this project, SEI US helped USEPA implement a cloud-based data management system for the CROMERR program, which regulates electronic reporting of environmental data to USEPA. We provided strategic advice about the design of the system and developed, tested, and deployed a variety of system components using Web and database technologies. Our work addressed key data collection and integration challenges faced by the CROMERR program, in particular how to collect comments from regulated entities and meet data retention requirements for electronic communications.

Adaptation & Vulnerability

Contact: Lisa Schipper, lisa.schipper@sei-us.org
<http://sei-us.org/Adaptation>

Climate change is no longer just a future concern; it is here and is challenging us now and for the foreseeable future. Even if we act promptly to reduce greenhouse gas emissions, the carbon we've already pumped into the atmosphere will continue to affect our climate system. Though climate science remains uncertain, and not all will be affected equally, we can expect that many parts of the world will see higher temperatures, sea-level rise, more frequent and intense natural hazards, and changed rainfall patterns.



There is no question that we need to adapt to climate change – but there are plenty of questions on how to adapt. Many countries and communities don't know where to begin: Should they build sea-walls as defense from sea-level rise and storm surges? Should they relocate entire communities living along riverbanks, in coastal zones, or on hills and mountains? Or do they need to go further, restructuring national institutions and policies or reshaping economic development priorities? Each of these approaches has different financial, social, environmental and political implications.

This is where SEI comes in: helping countries and communities to develop and then implement sound adaptation strategies. SEI has been working on adaptation, vulnerability and resilience issues for over a decade across its seven centers, helping to identify approaches that work in a broad range of situations. The adaptation program in SEI's U.S. Center, launched in 2011, focuses on five key areas: adaptation and migration; adaptation and sustainable development; adaptation and natural resources management; risk and culture; and adaptation and disaster risk reduction.

Selected Projects in 2013

Quito Vulnerability Study

Staff: Schipper, L.; Fencel, A.; Mehta, V.

Date: 2012-ongoing

Client/Funder: UK Department for International Development

Research Area(s): Adaptation & Vulnerability

Description: This project is evaluating climate change impacts, and vulnerability and adaptation issues, in the Quito, Ecuador, region to provide key information and guidelines to support adaptation planning and implementation. The goal is to increase the resilience of the Metropolitan District of Quito to the effects of climate change and enhance the sustainability of livelihoods and ecosystems in the region, especially for the most vulnerable sectors.

Contributions to the Intergovernmental Panel on Climate Change (cross-posted)

Staff: Kartha, S.; Schipper, L.; Klein, R.J.T.

Date: 2011-ongoing

Client/Funder: IPCC

Research Area(s): Climate Equity, Adaptation & Vulnerability

Description: This project is part of SEI's larger contribution to the *Fifth Assessment Report (AR5)* of the IPCC. Sivan Kartha is serving as Coordinating Lead Author of Chapter 4, "Sustainable Development and Equity", of Working Group III. He is also a coordinator of the Least Developed Country and Developing Country Contact Group, which was newly constituted at the spring 2012 Lead Authors Meeting, to help ensure that the AR5 is policy-relevant to developing country decision-makers. Lisa Schipper is Lead Author of Chapter 21, "Regional Context", of Working Group II. She was also a Lead Author of the IPCC *Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. The drafting of the AR5 began in spring 2011, and the report will be approved and issued at the end of 2014.

Communicating Clearly on Adaptation and Disaster Risk Reduction: Writeshops for Developing Country Scientists

Staff: Schipper, L.

Date: 2010-ongoing

Client/Funder: UN International Strategy for Disaster Reduction (UN/ISDR)

Description: There is growing concern about the small number of peer-reviewed journal articles on environment and development issues that are authored by developing-country scientists. To a great extent, this is due lack of training and experience, which creates a large capacity gap. In an effort to help close this gap, SEI and UN/ISDR have sponsored a series of "writeshops" for early-career scientists and practitioners who want to build their writing skills and bring their research findings to a global audience. The first writeshop was held in Bangkok in September 2010, and several more have been held since, around the world. The goal is to help participants get their work published in peer-reviewed journals.

PUBLICATIONS

Peer-reviewed journal articles

Averyt, K., **A. Huber-Lee**, J. Meldrum, P. Caldwell, G. Sun, S. McNulty, and N. Madden (2013). Sectoral contributions to surface water stress in the coterminous United States. *Environmental Research Letters*, 8(3): 035046.

Blanco-Gutierrez, I., D. Purkey, and C. Verela-Ortgea (2013). Integrated assessment of policy interventions for promoting sustainable irrigation in semi-arid environments: A hydro-economic modeling approach. *Journal of Environmental Management*, 128:144-160.

Bloom, E., **B. Joyce**, **D. Yates**, A. Draper, D. Groves, R. Juricich, and M. Rayej (2013). Evaluating resource management strategies for update 2013 of the California Water Plan. *Proceedings of the World Environmental and Water Resources Congress 2013*, 2391-2403.

Dermawana, A., **E. Kemp-Benedict**, **A. Huber-Lee**, and **A. Fencel** (2013). Testing a multi-scale scenario approach for smallholder tree plantations in Indonesia and Vietnam. *Technological Forecasting and Social Change*, 80(4): 762-771.

Erickson, P., M. Lazarus, C. Chandler, and S. Schultz (2013). Technologies, policies and measures for GHG abatement at the urban scale. *Greenhouse Gas Measurement and Management*, 3(1-2): 37-54.

Flores, F., and D. Yates (2013). A water system model for exploring electric energy alternatives in southeastern U.S. basins. *Environmental Research Letters*, 8(3): 035041.

Flores, F., Z.M. Easton, L.D. Geohring, P.J. Vermeulen, V.R. Haden, and T.S. Steenhuis (2013). Factors affecting phosphorus in groundwater in an alluvial valley aquifer: Implications for best management practices. *Water*, 5(2): 540-559.

Howells, M., **C. Young**, S. Hermann, M. Welsch, M. Bazilian, R. Segerstrom, T. Alfstad, D. Gielen, G. Fischer, H. van Vethuizen, D. Wiberg, R.A. Roehrl, P. Steduto, and I. Ramma (2013). Integrated analysis of climate change, land-use, energy and water strategies. *Nature Climate Change*, 3(7): 621-626.

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Lee, C.M., and M. Lazarus (2013). Bioenergy projects and sustainable development: Which project types offer the greatest benefits? *Climate and Development*, 5(4): 305-317.

Lee, C.M., M. Lazarus, G.R. Smith, K. Todd, and M. Weitz (2013). A ton is not always a ton: A road-test of landfill, manure, and afforestation/reforestation offset protocols in the U.S. carbon market. *Environmental Science & Policy*, 33: 53-62.

Mehta, V., B. Joyce, and D. Purkey (2013). Irrigation demand and supply, given projections of climate and land-use change in Yolo County, California. *Agricultural Water Management*, 117: 70-82.

Mehta, V., and E. Kemp-Benedict (2013). Social ecology of domestic water use in Bangalore. *Economic & Political Weekly*, 48(15): 40-50.

Mehta, V., D. Purkey, O. Aslam, L. Dale, and N. Miller (2013). Scenario-based water resources planning for utilities in the Lake Victoria region. *Physics and Chemistry of the Earth, Parts A/B/C*, 61-62: 22-31.

Rheinheimer, D., **J. Sieber**, **V. Mehta**, J. Viers, M. Kiparshy, and S. Ligare (2013). Simulating high elevation hydropower with regional climate warming in the West Slope Sierra Nevada. *Journal of Water Resources Planning and Management*, 140(5): 714-723.

Yates, D., and F. Flores (2013). Integrated impacts of future electricity mix scenarios on select southeastern U.S. water resources. *Environmental Research Letters*, 8(3): 035042.

Yates, D., F. Flores, J. Sieber, C. Young, K. Averyt, J. Meldrum, and S. Sattier (2013). A water resources model to explore the implications of energy alternatives in the southwestern U.S. *Environmental Research Letters*, 8(4): 045004.

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Reports

Erickson, P., E. Kemp-Benedict, M. Lazarus, and H. van Asselt (2013). *International trade and global greenhouse gas emissions: Could shifting the location of production bring GHG benefits?* SEI and 3C Project Report. <http://sei-us.org/publications/id/481>

Groves, D.G., **D. Yates, V. Mehta**, E. Bloom, and D.R. Johnson (2013). *Addressing climate change in local water agency plans: Demonstrating a simplified robust decision making approach in the California Sierra Foothills*. RAND Corporation Research Report RR-491-CEC. http://www.rand.org/pubs/research_reports/RR491.html

Working papers & white papers

Erickson, P., and M. Lazarus (2013). *Greenhouse gas emissions implications of the Keystone XL pipeline*. SEI Working Paper No. 2013-11. <http://sei-us.org/publications/id/504>

Lazarus, M., P. Erickson, L. Schneider, and A. Kollmuss (2013). *Potential for international offsets to provide a net decrease of GHG emissions*. SEI Working Paper No. 2013-06. <http://sei-us.org/publications/id/500>

Lee, C.M., C. Chandler, and M. Lazarus (2013). Assessing the climate impacts of cookstove projects: Issues in emissions accounting. <http://sei-us.org/publications/id/471>

Policy briefs

Baer, P., **S. Kartha**, and T. Athansiou (2013). *The three salient global mitigation pathways assessed in light of the IPCC carbon budgets*. SEI Discussion Brief. <http://sei-us.org/publications/id/506>

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Lazarus, M., P. Erickson, L. Schneider, and A. Kollmuss (2013). *Potential for international offsets to provide a net decrease of GHG emissions.* SEI Policy Brief. <http://sei-us.org/publications/id/503>

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Tansey, M.K., **Young, C., Flores, F.**, Van Lienden, B., Das, T., Munevar A., and J. L. Huntington (2013) *Effectiveness and trade-offs between portfolios of adaptation strategies addressing future climate and socioeconomic uncertainties in California's Central Valley.* American Geophysical Union Fall Meeting ePoster GC13C-1098, San Francisco, December 9-13. <http://abstractsearch.agu.org/meetings/2013/FM/sections/GC/sessions/GC13C/abstracts/GC13C-1098.html>

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